THE ELECTRICAL WORLD

A Weekly Review of Current Progress in Electricity and its Practical Applications

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The Electrical Transmission of Mechanical Energy.

(*Continued from page* 243.)

Although it is certain that energy cannot be destroyed any more than it can be created, yet we know that when it is converted from one form into another there is usually a small loss of useful effect realized. This is to be accounted for by the fact that a certain portion of the energy fails to be converted into the form desired, either in consequence of imperfections in the apparatus or else because certain conditions essential to a total conversion of the energy are lacking. We know, for instance, that even the best dynamo-electric machines, or, as we often say, the most *efficient*, do not convert into electricity all the mechanical energy supplied to them by the steam engine or other source from which they derive motion. Only a certain percentage of this mechanical energy appears as electrical energy, and that is the useful effect; the remainder appears as heat at the bearings, at the armature, etc. To designate this useful or available energy we employ the term "efficiency."

A dynamo electric machine capable of transforming 90

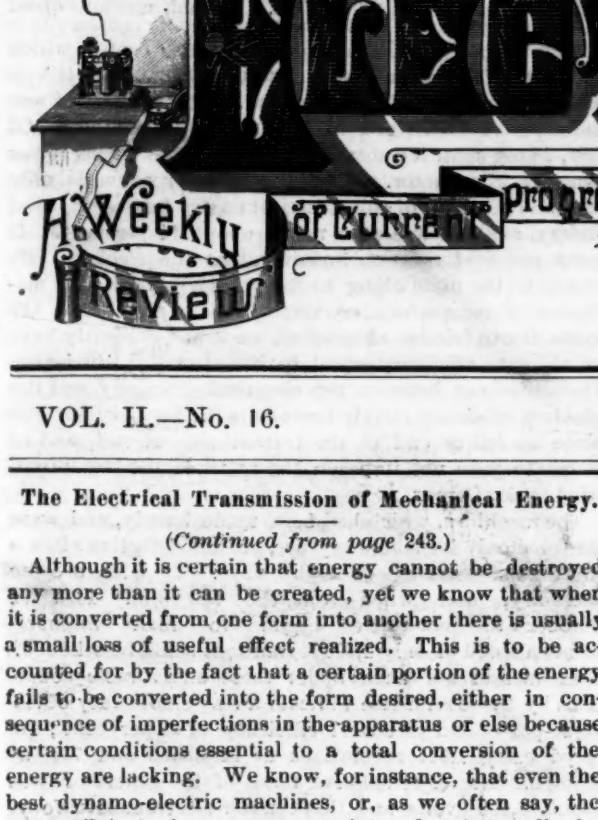

FIG. 3.—THE GENERATOR AT MIESBACH.

per cent. of the mechanical energy of rotation of the armature into electrical energy is said to have an efficiency of 90 per cent. The efficiency of a dynamo, therefore, is merely the ratio which the useful effect bears to the total energy supplied to it. To calculate this efficiency we have only to divide the useful effect, or the electrical energy produced, by the amount of mechanical energy applied to the armature pulley. Designating the mechanical energy by M and the electrical energy by m the ratio of efficiency K may be expressed by the formula

$$K = \frac{m}{M}$$

Thus if the power applied (M) were of 12-horse and there appears an electrical energy (m) equal to 10.8 horse power in the circuit then $\frac{10.8}{12} = \frac{9}{10} = 90$ per cent.

Now if the energy made available under the form of electrical current by the dynamo-electric machine is to be transmitted to a distance and there used to run another dynamo-electric machine as a motor for producing motive power, we must anticipate further loss in useful effect in consequence of the conversion of some current energy into heat in the circuit and in the motor. If we measure the power produced by the motor and divide this mechanical energy, which we may call m', by the electrical energy m we obtain the efficiency of transmission k. Thus $k = \frac{m'}{m}$ But this is not the absolute efficieney for m, the electrical energy only represents a certain percentage of the total energy M, as we showed above. To obtain the absolute efficiency k', therefore, we must divide the power obtained at the motor by the power originally supplied to the generator, or $k' = \frac{m'}{M}$. If the generator absorbed 12 horse-power and the motor reproduced 4 horse-power then $\frac{m'}{M}$ or $\frac{4}{12} = \frac{1}{3}$ or 33 per cent., which is the value of the absolute efficiency k'. The difference between the electrical energy given to the circuit by the generator and the mechanical energy obtained from the motor which represents the loss

M. DEPREZ'S EXPERIMENT AT MUNICH—THE INSTALLATION IN THE CRYSTAL PALACE.

in transmission, is due partly to imperfections in the motor and partly to the resistance of the circuit.

It was this loss in transmission which had discouraged all who had studied the problem of electrical transmission of mechanical energy to a distance, before M. Deprez attacked it. Certain experiments and the theory of mathematicians had shown that the maximum of work was made available by a motor when the useful effect or "duty" was 50 per cent. of the power applied to the generator. Moreover, the distance of transmission was evidently measured by the resistance, since the resistance of a conductor increases in direct proportion with its length. This seemed to indicate, therefore, that the greater the distance the greater the loss in transmission to be anticipated, and, in fact, the experience in electric lighting confirmed this view. To keep up the efficiency to the maximum of 50 per cent. indicated by theory, the only procedure which seemed practical was to increase the size of the conductor so that the increase in area of its cross section would be proportional to the augmentation of its length by distance, thus leaving the resistance the same.

By this means the distance, electrically considered, would remain the same. But this did not solve the problem, nevertheless, for it is clear that the distance of transmission was limited by the cost of copper in the conductors. A solution of the problem cannot be considered perfect unless it admits of "*the transmission of mechanical energy to a considerable distance without too great loss and without necessitating conductors too large and costly.*"

It was on the 15th of March, 1880, that M. Marcel Deprez first broached his celebrated theory, in a communication to the Académie des Sciences, in which he boldly enunciated the proposition, apparently so paradoxical, that "*in the electrical transmission of energy the efficiency is independent of the distance* of *transmission.*" This assertion was a thunderbolt of surprise to those who accepted the theory as it was then understood. It provoked discussions and contradictions without number, but left everybody incredulous. M. Deprez had deduced this theory by careful mathematical study, and a few experiments strengthened him in the conviction that he was right. He continued his mathematical analysis, and by April, 1881, he had succeeded in elucidating the whole subject of the transmission of energy of whatever form, by electricity, and shown that the same laws apply to every case. Taking as a basis the results of experiments made at Chatham by some English officers with a "C" Gramme machine, he made calculations of the results obtainable in transmitting mechanical energy by means of one such machine as generator wound with wire of a different diameter and run at a certain speed, using another identical machine as motor. It was shortly before the opening of the Paris electrical exposition that he published these calculations with the following surprising conclusion: *It is possible with two identical machines of type "C" to transmit an available work of ten horse-power to a distance of fifty kilometers (about 30 miles) by means of an ordinary telegraph wire, the initial motive power being about sixteen horse-power.* This announcement produced a sensation: for it promised a complete solution of the problem. Not only the distance of transmission was considerable, but the wire was not to be large nor costly, and above all the efficiency k was to be greater than theory had ever deemed possible, or $\frac{m}{M} = \frac{10}{16} = \frac{5}{8} = 62\frac{1}{2}$ per cent.

The theory of M. Deprez, which he fully elaborated before the International Congress of Electricians Oct. 1, 1883, made only a few adherents. There were those who did recognize the value of his ideas, but it did not seem possible that the results it indicated could ever be realized in practice.

What was lacking was the evidence of experimental demonstration, and it was this for which the Munich Exposition was destined to furnish an opportunity. The committee of the exposition proposed experiments of this nature, using telegraph wires, and M. Deprez accepted the offer. The detailed study of the theory of M. Deprez and of the means by which its results are to be attained will form the subject of a succeeding article, but before we proceed to describe this crucial experiment we will briefly mention the most salient points of this theory.

If we have two similar dynamo-electric machines, connected in series, and we apply power to the pulley of one, the other begins to rotate under the influence of the current generated by the first one. Now the current in circuit is what magnetizes the field magnets of both machines. The magnetic power of a magnet is equal to the volume of current, in ampères, multiplied by the number of turns of the helix magnetizing it. In this case the current being the same for both magnetic fields, and the number of turns of wire being also the same, it is plain that the magnetic fields must be of equal intensity. Now when an armature revolves in a magnetic field a current is induced in the wire constituting its windings. This induction will be produced whether a current is already passing through the armature or not. At the motor there is a current passing through the armature. It is this current which produces the motion of the armature. In this case the magnetic field will act inductively on the armature just as if this current were not there; but the electromotive force of induction will be in a contrary direction, because it is a consequence of Lenz's law, that the current induced is always such in direction that its reaction opposes the motion producing it. We have then a *counter-electromotive force* as the result of the motion of the armature of the motor. This electromotive force increases with the speed of rotation just as the electromotive force of the generator does. If the two machines are identical, then it is plain that at the same speed their electromotive forces will be equal. Now the lighter the load placed upon the motor the faster it will turn and the higher will the counter-electromotive force rise. Again, the available electromotive force in the circuit is clearly the difference between the two opposing electromotive forces. If the electromotive force of the generator (which we will designate by E) is 100 volts, and the counter electromotive force (designated by e) is 25 volts, then $(E - e)$ or $100 - 25 = 75$, the available electromotive force, which we may call e'.

We know from Ohm's law that the current (C) in a circuit is equal to the electromotive force divided by the resistance (R) or $C = \frac{E}{R}$.

Now when the motor is at rest, as it would be if held by an immense load, and the generator producing current, there will be, of course, no counter-electromotive force and the current will have the value of $\frac{E}{R}$; but now when the load is diminished and the motor starts it begins to produce a counter-electromotive force (e), and the available electromotive force is no longer E but $E - e$ or e', and the formula becomes $C = \frac{e'}{R}$.

The current C will have a lower value than before. The faster the motor is allowed to move, of course the smaller e' will be, and, consequently, the smaller the value of C. This means that when the speed of the motor is permitted to increase, a smaller amount of energy is transmitted. Let us see. The amount of energy appearing in an electrical circuit is equivalent, as will be explained in the next article, to the product of the current and electromotive force, thus, $C \times E$, or $C\ E$ as commonly written. The energy given off by the generator will therefore be $C\ E$ (using the same symbols as before). The energy appearing in the transmitting circuit, or what may be called the loss in transmission, will be the product of e' (the difference between E and e) and C, or Ce'. Now it is plain that the faster the motor runs the greater will be the counter-electromotive force e and the smaller the difference e', while the current C will also be of necessity smaller. This is a clear proof therefore of the fact that the smaller the *duty* or available work required of an electric motor the higher the *efficiency*, for the energy put into the circuit by the generator (CE) minus the energy lost (Ce') is evidently the electrical energy available to the motor, which, as we shall subsequently show, is expressed by Ce.

This is the whole essence of the theory of M. Deprez, stated in simple language. We see that the loss in transmission is the result of a certain relation which the electromotive force of the generator bears to that of the motor. The resistances do not appear at all in the formulas and consequently we may say with M. Deprez that "the efficiency of transmission is independent of the distance." It depends simply on the amount of energy to be transmitted or the duty required, as just stated.

The experiment of Munich, which proved this important law, was intended to have been made by transmitting mechanical energy from Augsburg to Munich, but the proprietor of a shop at Miesbach, Herr Fohr, having offered to furnish motive power, the latter place was decided upon. The distance between Miesbach, and Munich is 57 kilometres and the current from the generator (shown in Fig. 3) was conveyed by means of two ordinary telegraph wires 4½ milimetres in diameter, placed on poles as usual. The motor was placed in the Munich Crystal Palace and was belted to a centrifugal pump which fed a cascade nearly three metres in height, as shown in our front page illustration. The figures are reproduced from *La Lumière Electrique*. The total resistance of the wires was 940 ohms. The dynamos, both of the Gramme type, were wound with fine wire. The resistance of that at Miesbach was 470 ohms, and that at Munich 475 ohms. In the first experiment made Sept. 26, the electromotive forces were not measured. It has been shown by M. Deprez and others, however, that the electromotive force of a dynamo increases or decreases proportionally with the speed. So in this case having two identical machines, the ratio of their speeds will express that ratio of their electromotive forces which indicates the efficiency. This ratio may be expressed by dividing the counter-electromotive force of the motor by the electromotive force of the generator, or, what is the same thing, their speeds. The generator in this case had a speed of 2,200 and the motor speed of 1,500. The efficiency was therefore $\frac{1,500}{2,200} = 68+$ per cent. In this case the power measured at the motor was about one-half horse-power. If the load on the motor had been less, then its speed would have increased and the *efficiency* would have been greater, while, of course, the *duty* or available work would have been smaller. The energy absorbed by the generator was about one horse-power. It is plain that the ratio above given, which we call efficiency $\left(\frac{m'}{M}\right)$, is not the absolute efficiency, which was 50 per cent., but only the electrical efficiency $\left(\frac{m'}{m}\right)$. Let us explain. If each machine itself possessed an efficiency of 80 per cent., which is not far from the actual figure, it is easy to see that only 80 per cent. of the energy of one horse-power is delivered to the transmitting circuit. Of this, 68 per cent. is transmitted. This leaves about 55 per cent. at the motor. Now the motor reconverts only about 80 per cent. of this electrical energy into mechanical energy, and we have as a result about 44 per cent. It must not be forgotten, however, that the electrical efficiency is the main thing to be considered. If the machines were perfect converters of energy, and the losses due to friction eliminated, we would evidently have an absolute efficiency equal to the electrical efficiency. The difference between the electrical efficiency and the absolute efficiency merely represents the losses which take place at either end of the transmission circuit, and of course they do not impeach the merit of the law formulated by M. Deprez.

The machines, which had been made hastily, and were intended only for laboratory use, proved defective after a continuous working of eight days. Repairs became necessary, and when on the 9th and 10th of October the committee began to make measurements a speed of only 1,600 revolutions could be attained. Some measurents taken under these unfavorable conditions by the committee indicate an available duty of .43 horse-power and electrical efficiency of 39 per cent., the speed being 1,611 revolutions at Miesbach and 752 at Munich. The electromotive force of the generator was about 1,400 volts and the counter-electromotive force about 640 volts. The current in circuit was .4 ampère, nearly.

These results, though not as satisfactory as the first, were nevertheless sufficient to vindicate the reputation of M. Deprez, and they virtually forced electricians to acknowledge the accuracy of the theory he had so persistently defended. The report of the committee fully appreciated the possibilities which these experiments pointed out by its concluding phrase: "We do not hesitate to proclaim the success of the transmission of energy from Miesbach to Munich—a transmission which is at all events important in the history of the technical applications of electricity."

Shortly after these experiments M. Deprez offered to make other experiments which proved none the less interesting. We shall refer to these after we have explained M. Deprez's theory more fully.

[TO BE CONTINUED.]

Multiplex Synchronous Telegraphy.

At the regular meeting of the New York Electrical Society, on Friday evening, Dec. 7, the attendance was unusually large, owing to the announcement that Mr. P. B. Delany would describe his system of Synchronous Multiplex Telegraphy. Many prominent inventors and electricians were present. After the disposition of the routine business, including the change of night for holding the regular meetings from Friday to Wednesday, the principal event of the evening was reached. Mr. Delany's lecture need not be given here, as we were enabled last week, in advance, by the courtesy of Prof. Edwin J. Houston, of Philadelphia, to describe the invention in detail. An extended report of the lecture will be found, however, in *The Operator*. It may be added here that Mr. Delany pointed out that the system is admirably adapted to rented-wire service. Business men need not hire practical telegraphers, but can use a keyboard themselves and receive on an ordinary "ticker" or stock indicator. The cost of this service would be $500 per annum for a wire between New York and Philadelphia, against $4,600 for similar facilities furnished by the Western Union Company at present. Mr. Delany was warmly congratulated at the close of his remarks, and received the thanks of the Society. Mr. Callahan was also tendered thanks for his diagrams and models, which were of great assistance in elucidating the subject. The Society then adjourned, and its next meeting will be held on Wednesday night, Dec. 19, 1883.

A CORRECTION.—In Mr. E. Berliner's last letter, replying to Prof. Thompson in the Bell-Reis controversy, the clause as printed, "it does not assist at all," should read "it does not exist at all."

FROM SAMARKAND TO BOKHARA.—The telegraph has just appeared at another important commercial region in the Orient. The new line between Samarkand and Bokhara, which is the first constructed in Central Asia, and which has been made by the Russian Government, it is announced will be opened to the public this month. Communication will thus be opened between the silk merchants and manufacturers of Europe and the principal markets of Central Asia for cocoons and silk. Bokhara already contains 27 silk mills and 564 silk merchants.

Reviews of New Books.

THE MODERN APPLICATIONS OF ELECTRICITY. By E. Hospitalier. Translated and enlarged by Julius Maier, Ph. D. 2 vols., 8 vo. Second Edition. Price $8.00.

These volumes are a valuable addition to the literature of electricity. Their value consists not only in their contents as presented, but in the fact that they suggest to the intelligent reader new modes of procedure and point out the direction in which to make original research, as well as the fields in which to seek for improvements. The uses to which electricity is applied at the present time, and the prominent part which it displays in modern works of all kinds, makes a description of the appliances a work of considerable magnitude. But even the volumes under consideration, aggregating nine hundred pages, can only indicate the principal features of the various departments, each one of which could alone fill libraries without exhausting the subject. The author has, therefore, taken the principal and most interesting achievements in the various departments of applied electricity and presented them in a systematic manner, with sufficient detail to make the action intelligible. In glancing over the pages one is struck by their great diversity, and is led to the thought that the end has not nearly been reached.

The first volume of the work is divided into two parts, entitled respectively, "The Sources of Electricity," and "Electric Lighting." The former passes over those generators of electricity which have no longer any practical value, such as friction machines, and introduces at once electric batteries. A chapter is devoted to chemical and another to thermo-electric batteries; the latter is of especial interest in view of the fact that these are comparatively little known. Chapter III. describes generators of the dynamo and magneto-electric principle, including all the well-known types of that numerous class. We remark here that the illustration showing the Weston machine is that of the old style, which has been discarded these two years. Under the head of Chapter IV. the author groups apparatus for transforming electricity. He explains this title to mean all such apparatus in which electricity is no longer produced directly, but is transformed and changes its properties. Under this classification storage batteries and induction coils are placed side by side, two things of an entirely different nature. While, according to the definition, this classification is legitimate, it nevertheless strikes us that a better one might have been made.

Having thus described the sources of electricity, the author enters into its various applications. Of these, electric lighting takes up the second part of Vol. I. All the well-known lamps and candles are described, including both arc and incandescent systems. Mention is made of a large variety of instances in which they are applied, not only in street or domestic illumination, but also special applications, such as the illumination of vessels, railway-trains, signaling, mining, military and naval operations, submarine exploration, photography and microscopy.

The telephone forms the subject matter of the first half of Vol. II. Various systems of communication are described, including everything connected with them. Then follow the uses of the telephone and microphone in medicine and scientific research, among which are described Ducretet's Stethoscopic Microphone and Hughes' Induction Balance.

Part II. of this volume is divided into chapters devoted to a variety of miscellaneous applications of electricity, each having space enough allowed to admit of intelligent description. We can best indicate the contents of this part by giving the titles of the chapters which compose it. They are the following: I. Methanometers, or apparatus for indicating the quantity of fire-damp in coal mines. II. Fire Alarms. III. Electric Water Gauges. IV. Electrical Appliances for Navigation. V. Electrical Appliances for Meteorological Observations. VI. Electro-Sorting. VII. Electro-Metallurgy. VIII. Electrolytical Methods applied to Manufacturing Processes. IX. Electro-Medical Appliances. X. Preparation of Parabolical Mirrors by Centrifugal Force. XI. Etching on Glass by Electricity. XII. Electrical Appliances for Railway Intercommunication. XIII. Bourdin's Plough for laying Electric Cables. XIV. Siemens' Galvanometers. XV. Raimond Coulon's Photometer.

It will be seen from this enumeration that the ground is almost entirely covered; and it would be well-nigh impossible to mention every single use to which electricity is applied.

One of the most interesting parts of the work is that on the transmission of power, which ends the volume. The author enters into the theory of the subject at some length, presenting it in a clear light. It introduces of course the various motors and their application to domestic purposes, railways and a number of other uses.

The work is illustrated throughout by fine cuts and explanatory diagrams, which go a great way toward making a comprehensive work of this kind perfect; and, taken as a whole, it must without doubt prove a useful book of instruction and of reference.

It is fitting to state here that this work or any other treating of electricity may be obtained from the office of THE ELECTRICAL WORLD, upon remitting the price.

Electric Lighting at Providence, R. I.

Competition has its attendant evils and disadvantages as well as monopoly, and this truism is well supported by the manner in which some of the later discoveries in electricity have undergone commercial development and application. It is thought by many persons that the Bell Telephone monopoly is a bad thing in every way, and that it actually has some influence in keeping back the millennium. But, on the other hand, taking the electric light business, in which unrestricted competition is the rule, it appears that anxiety to occupy and exploit certain territory leads to the most embittered controversy by tongue and pen and all the other enginery capable of affecting the judgment of men. The consequences are not beneficial to the electric light.

The city of Providence, R. I., supplies a good example of the unhappy rivalry now going on. Some months ago the American Electric and Illuminating Company, of Boston, of which Mr. Edward H. Goff is president, hired premises in Providence, and equipped them with a plant of which the total cost in cash was $60,000. The system of the company is the Thomson-Houston. Having put the installation in working order, the company applied to the city council for permission to run its wires in certain streets. The petition was referred to a joint special committee of both branches of the council, for a public hearing; and then came the tug of war. The Rhode Island Electric Light Company, which already had a Weston plant in operation in the city, protested against the introduction of the other system. The objections raised were of a personal character, and related to the connection of Mr. Goff with the defunct American Electric Light Co. of Massachusetts. Mr. Goff was able to make it clear, however, that he had been induced to become vice-president of that corporation under false pretenses, that he was connected with it only twelve weeks, and that on discovering that he and his friends had been deceived he spent $40,000 of his private fortune in buying back stock from those who had been induced to make an investment by the fact of his connection with the company. Strange to say, next day a garbled version of the hearing, omitting the evidence for the petitioners and giving at length that for the opponents, appeared in a Boston paper, and marked copies of that paper are said to have been distributed by mail all over New England, wherever they might do the most harm.

The outcome of the controversy has been satisfactory to the Boston company. The Common Council of Providence has concurred in an ordinance passed by the Aldermen granting permission to the American Electric and Illuminating Company to erect poles and stretch wires in the public streets, and the Narragansett Electric Light Company has been organized for the purpose of buying the station and plant. The following board of directors was elected on the 5th: Hon. H. J. Spooner, member of Congress from the Providence district; Col. Isaac M. Potter, Frederick J. Marcy, S. W. Peckham and J. G. Markland, John B. Allen, Martin V. Brady, C. D. Smith, all of Providence, and Maj. Everett S. Horton, of Attleboro, Mass. At a subsequent meeting of the board the following officers were elected: Isaac M. Potter, president; John B. Allen, vice-president; Martin V. Brady, treasurer; J. G. Markland, secretary; C. D. Smith, general manager; Henry C. Bradford, superintendent. The system is finding much favor with local merchants and storekeepers, many of whom supported the petition.

The Indianapolis Headlight.

The best headlights of the present form on locomotives have, it is said, a power of about thirty candles only, and a stronger, steady light for the purpose has long been a *desideratum*. We have already published particulars from time to time of experiments in this direction, here and in Europe, and have mentioned that two electricians at Indianapolis, among others, were engaged trying to meet the want. The result of their work is given in the Chicago *Tribune*, of the 28th ult, as follows:

"Last evening the principal officers of the stock company formed to manufacture the new machines, together with many prominent railway men of this city and members of the press, were shown the successful working of the new light and locomotive owned by the Western Indiana Railway Company. The party started from the Union Depot, at Polk street and Third avenue, and went out on the road about twenty miles. The light worked to perfection and the track was lighted in a brilliant manner for a distance of fully one third of a mile ahead. The color of a freight-car standing on a side-track fully four telegraph poles ahead was clearly distinguished. By this light any obstruction or defective bridge can be plainly enough seen to enable a skillful engineer to stop his train long before reaching it. The jar and rocking of the engine produced no effect; the light was as steady when the engine was in motion as when standing still. By certain rods the engineer can turn the reflector and throw this brilliant light to either side of the track, making it possible to light up a curve as plainly as a piece of straight track. The wonderful invention delighted all present.

"The machine is very simple, and consists of a small disc-engine furnished with steam from the locomotive by connecting pipes and a dynamo machine. The engine is of three-horse power, and the weight of all is only 500 pounds. The engine works at all times, and can be stopped by the engineer at will by simply shutting off the steam from the locomotive. The clock-work of the feeding to the carbon-points is all inside the headlight case, which is placed as usual in front of the smokestack on the head or the boiler. Wires lead from the dynamo machine, which can be placed anywhere about the locomotive as may prove desirable, to the headlight, and carry the electricity. The invention lies in a perfect double pendulum and counterpoise, which renders it impossible for the carbons to touch for more than an instant, and this is attached to the clock-work. The feeding of the upper carbon is controlled by the counterpoise. When the carbon is so low down as to form a continuous circuit a magnet raises the counterpoise. This stops the feeding of the carbon, which burns enough to weaken the current. Then the counterpoise drops back, starting the feeding again. The double pendulums render it impossible for the light to go out."

If the light be all that is thus claimed, it is practicable and satisfactory to a larger degree than was expected. There are, no doubt, minor defects to be overcome and details to be perfected; and when this is accomplished we may look for a general and speedy adoption of the headlight on the railroads throughout the country.

Telephonic Growth in Michigan.

The increasing use of the telephone in Michigan is but a fair measure of its popularity in every other part of the country. The *Eagle*, of Grand Rapids, Mich., has obtained from Supt. Watson, who has charge of the system in Western Michigan, some interesting figures with regard to extension in that part of the State. The Grand Rapids Exchange was opened in June, 1879, has already 550 subscribers, and is adding to the number at the rate of about ten or fifteen every month. The system gives employment locally to a manager, a chief operator, fifteen operators, four linemen, two clerks and a messenger. It was found necessary, soon after the service was established, to connect with Grand Haven, Muskegon and intermediate points.

The system is now connected with Grand Haven, Muskegon, Whitehall and Montague, Newaygo, Big Rapids, White Cloud and Hesperia, Holland City, Howard City, Lowell, Ionia, Portland, Lansing, Greenville, Stanton, Edmore and intermediate points—some fifty cities and hamlets in all. A line has just been completed from Big Rapids to Reed City. Another line is building from Edmore to Lake View, and another from Montague to Hart, taking in Shelby. When these are completed, work on the trunk lines will be suspended until next season. In several directions, so large has the business grown, two trunk lines have been erected. That is the case from Grand Rapids to Lowell, one of them being needed to accommodate the business of that village alone. It is also the case to Newaygo, for lines radiate from there to White Cloud, to Big Rapids, to Hesperia *via* Fremont Center and to Muskegon *via* Bridgeton. A similar condition exists between Grand Rapids and Grand Haven, at least a part of the way.

Next season now promises to be quite as busy as this has been, in extending the system. In all probability a connection will be made with Ludington and Manistee, as the Western District now includes them and the whole region south to and including Kalamazoo; and both Ludington and Manistee have exchanges already. The line now built to Howard City will probably be extended to Big Rapids, making a second line to that point. A line will be built to Allegan and Kalamazoo *via* the Lake Shore and Michigan Southern Railroad. A line will be built down the valley road, how far is not certain, but probably to Jackson, which is not as far as Reed City is now, *via* Newaygo. And the present lines will be improved.

Safety of Accumulators.

To the Editor of The Electrical World:

SIR: From observation I have noticed that the general impression among those who are not familiar with accumulators, or secondary batteries, is, that they are very dangerous things to approach. It was stated in one of our leading papers, the other day, that secondary batteries were unfit for commercial purposes, because of the great danger attending their use; that if any person should happen to touch one of the wires attached to them the shock would prove fatal.

Having had seven months' practical experience with them, I can prove that, on the contrary, the secondary battery is the very embodiment of safety. I have worked around them in every conceivable manner, at times standing on bare ground, my hands wet with acidulated water, handling bare wires connected with the poles of a series of twenty or thirty cells, yet never have received a shock sufficient to give me the slightest injury.

Just only the other day, so confident was I of the safety of the secondary batteries, that I connected two No. 16 electric light wires to a number of cells, which gave out an E. M. F. of sixty-two volts; then taking the bare ends of these two wires placed them on either side of my tongue, and received no harm whatever. The sensation produced was about like that from a small Faradic battery.

RHESA G. DUBOIS.

WASHINGTON, D. C., Dec. 3, 1883.

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The Case for Aerial Arc Light Wires.

Following up the presentation of the report of the Finance Committee against aerial arc light wires, the Board of Aldermen of this city adopted Saturday a resolution requesting the Board of Health to furnish it with a return of the number of deaths caused by the use of electric wires in the city during the last three years. The Fire Commissioners were requested to report to the Board the number of fires originating through electric wires during the same period, the loss caused by the same, as well as personal injuries received by any member of the department in consequence of the wires.

To judge from the thrilling and tragic stories told by a leading metropolitan journal of accidents resulting from the use of aerial arc light wires, one might expect that the returns made by these authorities appealed to for information would be startling in their recital of wholesale l of life and destruction of property. But as far as a representative of THE ELECTRICAL WORLD can learn, after a minute and careful inquiry during the present week, the damage done to property by fires originating from arc light wires is so small as not to be worthy of mention, and the only death on record traceable in any way to electric light wires is that of an employé of the Brush Company, who had the misfortune to complete the circuit through his body while at work. The various sensational items that have been served up to the public with suspicious regularity every morning, for weeks past, become, on inquiry, the fictions of a Munchausen.

Evidence as to the number of fires caused in this city by the use of electric wires during the three years is easily obtained, and we print it in advance of the statement that the Fire Commissioners have been invited to prepare. The facts we quote are from the official records, and are contained in an affidavit made by Fire Marshal Sheldon. It is to be remembered that there are now about 2,000 arc lights in active service in New York, on about 400 miles of circuit. The first case dates back to the month of May, 1881, when a fire on the 15th, occurring on the outside of the carpet store of Sheppard Knapp, in Sixth avenue, was caused by sparks from Weston wires, which were attached to the side of the building and near the roof of an adjoining building, and fastened by iron hooks; and at that point the fire seemed to have started. Later in the month a fire causing no damage was supposed to originate from sparks of Weston wires in a lager beer saloon in West Fourteenth Street. On Oct. 24, 1881, a fire originated on the second floor of the building known as the Germania Theatre, Broadway. Its cause was a defect in the wire of the Brush Company. The wire was taken across the top of a sign covered with tin, and fastened to it with iron staples. At one point the insulation was abraded, and the wire was there wrapped with rags. The current escaped, melting the solder and tin and setting fire to the woodwork. In the same month the crossing of the wires of the Fire Department with one of the Brush wires at Broadway and Pearl street, resulted in burning out the relay magnets in the Central Office Fire Alarm Telegraph, destroying the magnets in three of the signal boxes, and injuring other boxes. Just about a year later, on Oct. 13, 1882, the wires of the United States Co. became disconnected in West Washington Market, through the ignorance of a boy using the light, and sparks ignited the woodwork. On Dec. 10 a fire originated in the area of 174 William street, owing, it is supposed, to the defective insulation of Edison light wires. The damage was $50. During this year only four cases were reported. On June 10 damage to the amount of $20 was done by a fire at 121 Front street. The insulation of the Edison light wires was defective and the current escaped at a point where the iron pipe inclosing the wire was bent. At Miner's Theatre, on the Bowery, a fire occurred on Sept. 10, the wire of the New York Electric Light Co. igniting the wooden collar on footlight. On Sept. 3 the Edison wires ignited rubbish under a floor at 88 South street. It is supposed that the insulation had become defective. The damage was only $5. On Oct. 3 another little fire occurred at Miner's Theatre, owing to the ignition by the wires of the wooden ring around the burner.

Such, then, is the official statement of the damage done by all the electric-light wires in three years! It will be seen that the loss of property is paltry in the extreme, and that in point of fact incandescent-light wires have more to answer for than the arc-light wires. This statement must be taken, therefore, not as a condemnation, but as a vindication of aerial systems, and really places them in a more favorable position than their warmest friends had hoped for them after the late fierce attacks.

Our investigation does not, however, stop here. It was reported that last week three firemen, in putting out a fire on the Bowery, had received a shock from an aerial electric light wire. Up to this time no trace has been discovered of the firemen in question, so that there is reason to infer that the guileless reporter was unwittingly imposed upon. This week a story was printed to the effect that on the 8th, while linemen of the Metropolitan Telephone Co. were stretching a wire across Fourteenth street, between Broadway and Fifth avenue, the wire broke, fell across a Brush wire and deflected a portion of current from the latter; and that a passing team came in contact with the fallen wire and received a bad shock, which their driver shared. The narrative was most vivid and circumstantial, but inquiry does not develop anything more remarkable than that the horses were entangled in the wire, and that the driver thought so little of the matter that he did not even report it to his "boss."

Pursuing the search after truth, yet a little further, it is found that the graphic description of the torture inflicted by electrical currents two weeks ago on a runaway horse that broke down one of the electric lamp poles in Fifth avenue and became netted in the wire, is almost entirely without foundation. It is true that a horse ran away. It is also true that he pulled down pole and wire. But his injuries as described were not the result of electric shocks. It is amusing to notice in this respect how the newspaper man has contradicted himself. In one issue of the paper it is stated that the shock will kill instantaneously, and yet in another the world is gravely informed that "for two hours the poor brute lay enduring the force of a current strong enough to charge the harness and coupé attached, and to knock down men who touched them, before word could be sent to the Brush headquarters, and the current could be cut off." But what, after all, was the condition of the horse that involuntarily made itself the martyr of scientific experiment? According to two affidavits, made by veterinary surgeons, and copies of which we have obtained, the horse, although tangled in the wire that it had knocked down, received no appreciable shock. The affidavit of Dr. Edward Loomes says that the horse, when examined, was suffering from the fall and from severe lacerations caused by his struggles in the wire. "The theory of receiving a shock of electricity I cannot believe." Dr. Alexander Lockhart, who had Drs. Robertson and Michener in consultation with him, swears to his opinion and theirs that there is not the slightest foundation for the assertion that the horse was affected by electricity, but that all the wounds on him were produced by his getting entangled in the wires. On the 7th the horse was doing well in the Doctor's infirmary, and the report of him there was, "in a few days he will be fit for work."

THE ELECTRICAL WORLD has been at some pains to get at the facts, in order that the scientific truths involved may be established and the public mind, now rendered uneasy, may be reassured. The effect of all these attacks and controversies is bad, not merely in regard to the arc light, but also as concerns the incandescent light; and the fact that the stock of one of the incandescent companies credited in many quarters with instigating the attack is quoted at very low figures ought to be instructive. Persistent warfare of this kind on men and institutions does not inspire on-lookers with much confidence in the purity of the motives of the assailant. It is not surprising, therefore, to hear it openly said that the attacking journal has placed its columns by sale at the disposal of the enemies of the arc light, whether they be advocates of the incandescent light or the promoters of underground cable schemes.

Justice for the Military Telegraphers.

The Society of the U. S. Military Telegraph Corps, composed of the telegraphers who served with the various armies of the country during the Civil War, is making an effort to secure justice from Congress, in the form of recognition of their services. While the great struggle lasted, operators to the aggregate number of about 1,200, besides line builders and repair men, were employed in keeping up communication between the scattered forces of the Republic and in transmitting invaluable intelligence for the information of the government, the generals and the people. So largely did the fortunes of the contest depend upon the efficiency of the telegraph service that 15,000 miles of military line were built, over which no fewer than 6,500,000 telegrams passed; and much of the work was done at the front, one in twelve of the operators being killed, wounded, captured, or otherwise rendered useless to his family and friends. As to the manner in which the work was done, the courage and efficiency and fidelity with which the telegraphers toiled at their posts, Generals Sherman, Palmer, McClellan, Warren, the late Secretary Stanton and many other authorities, have borne the most willing and eulogistic testimony, presented pithily by General Sherman in this statement: "The greater number were distributed along the lines, had to work day and night, and were as much a part of the army as though armed with muskets in the ranks; for, before the discovery of the magnetic telegraph, the sending of messages back and forth, to and fro, was always done by armed cavalry, messengers and escorts, consuming a large portion of the active army. In fact, there should have been in the civil war a regular corps of telegraph operators, with regular muster-roll, so that the wounded could be entitled to the same pension as other staff soldiers and officers."

The history of the telegraphic operations of the war was clearly given by the president of the society, W. R. Plum, in his annual address before it at Chicago, on Sept. 19; and, fortified with this convincing plea, the military telegraphers ought to be able to secure justice from Congress. The bill to be introduced in the Senate and the House provides that they shall be given military status according to position and service, and that the members of the corps shall be entitled to rights of pension and homestead entry and to an honorable discharge, upon the same terms and conditions as other officers and soldiers of the Union army of the war. Seeing that the signal service men and others, too, not actually fighting, had military rank and standing, the telegraphers are simply asking for their due, and we heartily trust that they will get it without further delay.

Government Telegraph Schemes.

As we predicted, there is no lack of schemes before Congress for vesting in the government control of a national system of telegraphs. Last week we gave the main features of Senator Edmunds' scheme. A very weak point in that is that it would create a line to compete with existing lines. Senator Hill, of Colorado, has introduced another bill that deals with the telephone and "other equivalent device," as well as with the telegraph, and that authorizes the Postmaster-General to acquire by contract and purchase all the facilities he needs for a government service. The charge for transmission between all places in the United

States shall be, unless otherwise provided, at the rate of one cent per word, counting date, address and signature, and prepaid by stamps. The Postmaster-General may lease short lines to persons wishing to hire them, but no messages shall be sent by such lessees for hire. The Postmaster-General may also negotiate with foreign governments, or with persons or corporations owning ocean cables or telegraph lines in foreign countries, for the interchange of telegraphic correspondence and money orders. The following is a significant clause:

"If at any time any person or corporation shall transmit messages, or rent lines between points connected by postal telegraph at less than the rates fixed by law or regulation, as hereinbefore provided, the Postmaster-General may thereupon reduce the rates so fixed to a level with the rates charged by such person or corporation. Provided, that such reduction shall continue in force only so long as said rates are maintained by such person or corporation."

Next comes the measure to be brought before the House of Representatives by Congressman Anderson, of Kansas. It is a revision of the bill introduced by him last session. It provides that the Postmaster-General can construct, maintain and operate three main lines of telegraph—northern, central and southern—of a total length of 9,110 miles, and costing, at the maximum estimate of $400 per mile, $3,644.000. He is authorized to connect the wires of the postal telegraph with those of any telegraph company accepting the terms of the act of July 24, 1866, securing to the government the use of telegraph lines; the said companies conveying messages at the government rates. The bill provides for the issuance of $6,000,000, in three per cent. bonds of $1,000, the proceeds of the sale being devoted to the work, at the cost of not more than $500 per mile for six wires. The rate of charge for transmission by the Morse method shall be thirty cents for ten words or less, exclusive of address and signature. "If the fac-simile process is used, the unit of charge shall be a letter sheet and a note sheet, the dimensions of which shall be designated by the Postmaster-General. The charge for the letter size shall not exceed fifty cents, and for the note size thirty cents." The bill also provides that old military lines, if no longer needed, shall be handed over to the Postmaster-General for the use of the new service, that he may connect the postal lines with those of any subsidized railroad or telegraph company, and that he may establish telegraph or telephone lines between main and sub-post-offices in the same or adjacent cities, or between any station and those patrons who will meet the cost of such lines or furnish their own.

With all these proposals before it, Congress can, if it has any desire for a government telegraph service, find something to its taste. Its action on the question will be watched with interest, not only by the public but by some corporations that we could name.

Important Treatises Wanted.

Evidence of the increasing importance of electricity is found in the fact that in the list of papers that will be received by the Council of the Institution of Civil Engineers for reading and discussion at their meetings, or for publication in their Transactions, are named several electrical subjects. The list includes mechanical power on tramways, including steam, compressed air, electricity, cables, etc., and it seems to us that this is a theme worthy also the earnest consideration of humane societies, for the sake of the strained and tortured horses. Another subject is the methods and appliances for blasting rock under water. The subjects in the class distinctively electrical are: electro-motors, their construction, efficiency, and power: gearing for dynamo-machine motors and other high-speed engines; the transmission and distribution of electricity over large areas for lighting and for motive power, including electric railways and hoists; electrical measuring instruments; submarine telegraph cables, their manufacture, laying and repair, including deep-sea sounding methods and appliances; "telepherage," or the automatic transportation, by means of electricity, of goods and passengers. This is an extensive field for investigation and discussion.

OUR UNPROTECTED COAST.—This country has a coast line of enormous length as well as great accessibility, and the fleet for its protection is one that the Chinese even do not hold in high estimation. If we are to have no better fleet, means of defence must be found, says the U. S. Chief of Engineers in his report as quoted by the Secretary of War, in barbette batteries and an efficient system of torpedoes. The attention of Congress is therefore invited to the imperative necessity for electrical rooms and cable galleries for the most important of the sea-coast works. No matter how well developed the torpedo system may be, it will be of little use unless the instruments for discharging submarine mines, and the connecting cables employed, are protected from artillery such as modern ironclads can level against them. "There should," adds the report, "certainly be no further delay in constructing these comparatively inexpensive but absolutely necessary adjuncts to the system of torpedo defence." Seeing that the naval, artillery and torpedo services have in them electricians of distinguished attainments, the difficulties in providing for the emergencies of an attack could all be overcome were Congress only to set aside the means for carrying out the work.

The Construction and Equipment of Lines.

In our last issue we published a review calling attention to some of the merits of Lieut. Swift's admirable work, "The Practical Telegrapher."* We then endeavored to give an idea of the scope of the volume in a general way, and reproduced some of its illustrations from the chapter on "Construction and Equipment of Lines," which is one of the most valuable in the book. Lieut. Swift has the details of this part of the subject at his fingers' ends, and we do not think that so much useful practical information has ever been brought together before, either here or in Europe. We now give a few more cuts from the same chapter.

Fig. 14 shows an arrangement as described in the chapter, for lightning conductors, on a pole having cross-arms attached, with branch connections leading to the insulators, but not connected with them. Fig. 19 shows the manner of making a joint in line wire, and fig. 20 shows how the joint should look when completed. The method of fastening the wire to the insulators is illustrated in fig. 28. The method of attaching insulators in cases where trees are used as supports is shown in fig. 30, accompanied by fig. 29, a perspective drawing of the tree insulator, which is fitted to the bracket and attached to the trunk. The other two cuts, figs. 34 and 35, pertain to the section of the chapter dealing with housetop wires, and explain themselves.

To be fully appreciated, however, the chapter must be

FIG. 28.

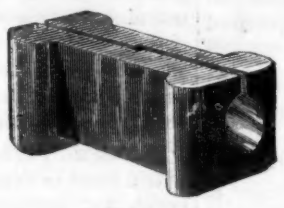


FIG. 29.

FIG. 20.

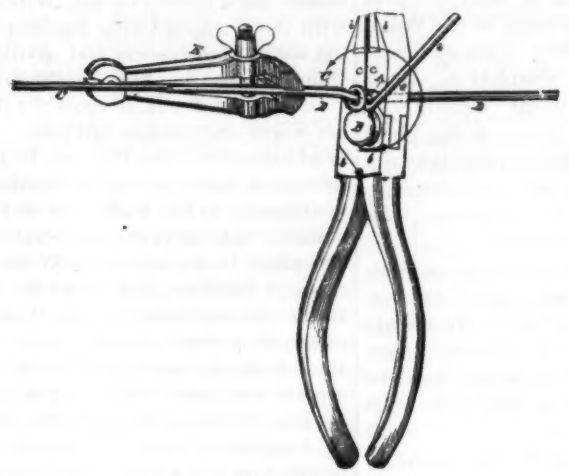


FIG. 19.

FIG. 30.

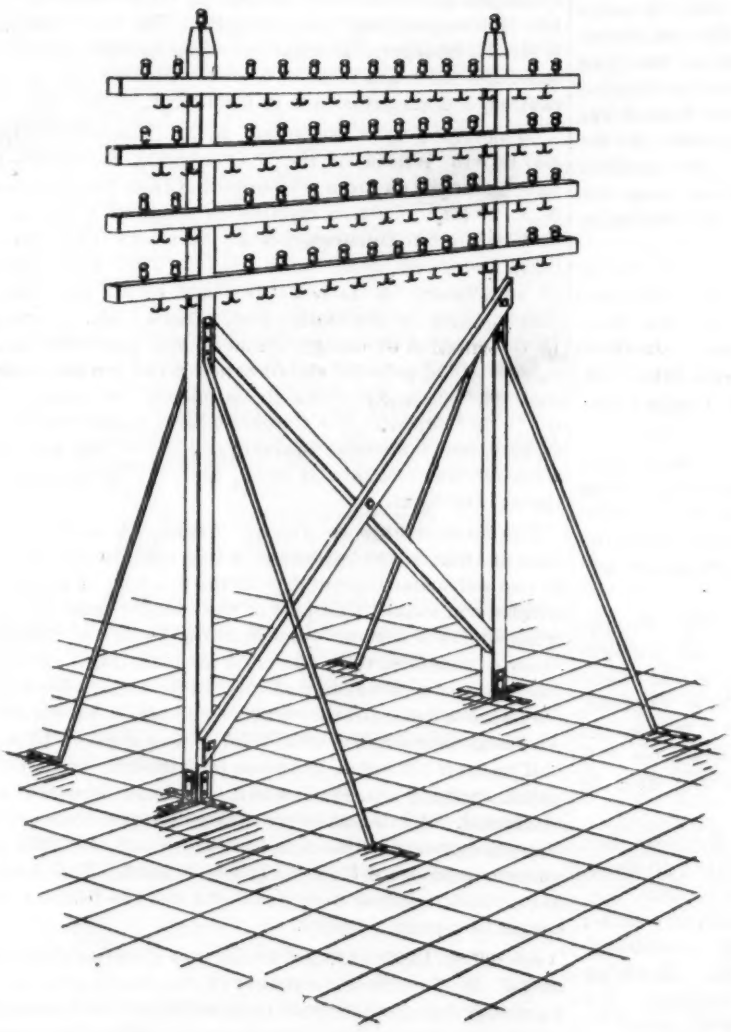


FIG. 35.

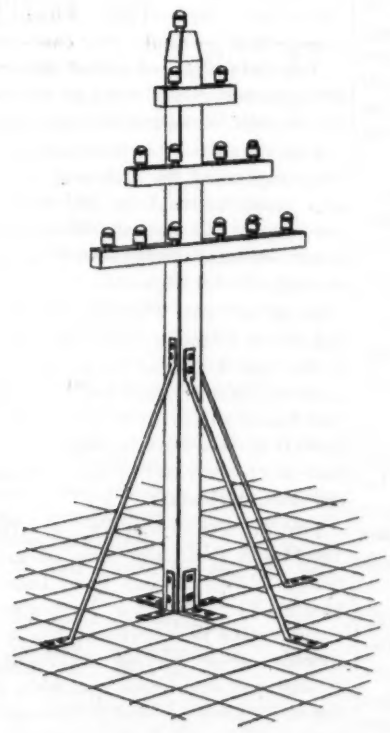


FIG. 34.

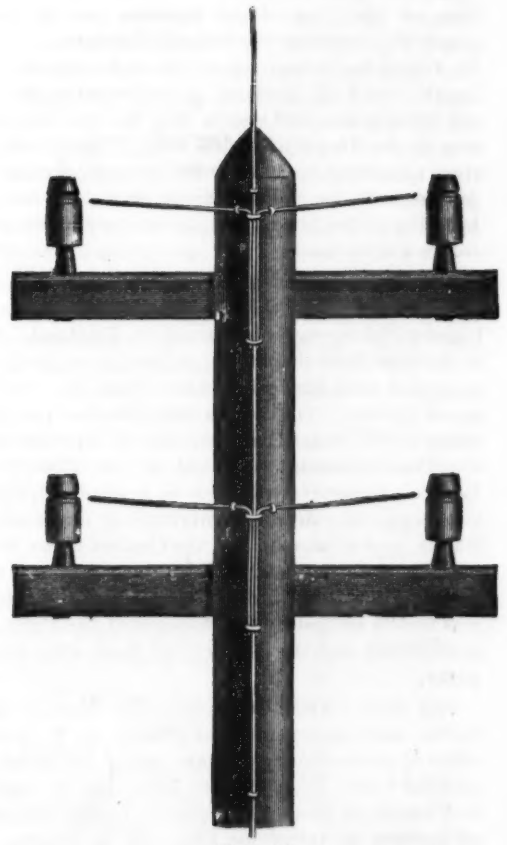


FIG. 14.

*THE PRACTICAL TELEGRAPHER: A manual of Practical Telegraphy and Telegraph Construction, by Lieut. Jas. A. Swift, U. S. Signal Corps. W. J. Johnston, New York 1883. $1.50.

read as a whole. Certainly nothing more practical or written in more easy and clear language has hitherto appeared.

THE TELEGRAPH.

A NEW LINE IN MISSISSIPPI.—A new telegraph line has just been completed between Vicksburg and Yazoo City, Miss.

NEW ABBREVIATIONS FOR TICKERS.—The Gold and Stock Telegraph Co. have adopted a new system of abbreviations in their quotations.

CABLE DESTROYED.—The American Rapid Telegraph Company's cable under the river at Cleveland, O., was destroyed a few days since by a tug dropping anchor against it.

THE Pacific Mutual Telegraph Co., say the Kansas City papers, made their connections from that city with St. Louis and Chicago on the 19th ult., and handled all business offered.

A FIVE HUNDRED DOLLAR BULL.—Messrs. N. K. Fairbank & Co., of Chicago, have brought suit to recover $500 damages of the Western Union Telegraph Company for making a mistake in the transmission of a message.

MR. MACKEY'S MOVEMENTS.—Mr. John W. Mackey leaves in a day or two for Europe, and his friends in the Postal Company say that he has left behind him funds sufficient to push all the proposed extensions to completion. He is said to have invested $2,000,000 in the project already.

ANOTHER MISSISSIPPI CABLE.—The Texas & St. Louis Railroad (narrow gauge) is laying a telegraph cable between Bird's Point, Mo., and Cairo, Ill. The cable contains several wires, one of which is to be used as a telephone wire connecting Cairo telephones with Bird's Point.

THE SOUTHERN AND ATLANTIC COMPANY.—The new directors of the Southern and Atlantic Telegraph Company, on Wednesday, the 12th, elected Norvin Green, President; Thomas T. Eckert, Vice-President; R. N. Worcester, Secretary and Treasurer; Executive Committee, Augustus Schell, Thos. T. Eckert, A. B. Graves and John Van Horne.

A HEAVY CONTRACT.—The contract for the construction of the line of the Bankers and Merchants' Telegraph Co. between Pittsburgh, Columbus, Cincinnati and St. Louis, has been awarded to John H. Miller, of Pittsburgh, and J. H. Borland, of Wilkesbarre. Mr. Miller is an old telegrapher, and was largely engaged in the construction of the American Rapid lines. The terms of the contract are private. It includes the construction of the lines between all the points named, but does not require the building of the lines through the cities where underground cables will be used.

BOGUS CABLE MESSAGES.—A few weeks ago some sensation was caused by the revelations made in regard to the bogus cable messages published in England. We showed at the time how dispatches of twenty or thirty words were amplified until they filled more than an ordinary newspaper column. On the 7th inst. further particulars were made public in another libel case of the Central News *vs.* the Press Association, heard in the Court of Queen's Bench. Evidence was given by a telegraph operator as to the receipt of a message announcing a disastrous fire in Russia, and a sub-editor of the Central News deposed that he expanded the message from nine to ninety words. The dirty linen having thus been washed in public, the case was finally settled by the Manager of the Press Association apologizing, and the payment of their own costs by each party.

THE NEW CABLE COMPANY.—The Mackey-Bennett Cable Co. was incorporated at Albany, N. Y., Dec. 12, at the office of the Secretary of State, under the name of the Commercial Cable Co. Besides intending to operate cables and telegraph lines the company claims the right to use all its lines as telephone lines and to become the owners or lessees of all or any patents for inventions connected with telegraphy or telephony. The capital stock is $4,000,000, divided in 40,000 shares of $100, with power to increase said capital stock from time to time, and by such amounts as may be necessary to represent the cost of building and constructing the lines. The shareholders are John W. Mackey, Virginia, Nev., 20,000 shares; Isaac Bell, Jr., Newport, R. I., 10,000 shares; Hector De Castro, New York City, 5,000 shares; David B. Davidson, Brooklyn, 5,000 shares.

THE WESTERN UNION DIVIDEND.—At the usual weekly meeting of the Executive Committee of the Western Union Telegraph Company on Wednesday, the 12th, President Norvin Green stated that since the opening of the books, Oct. 16, the number of stockholders of the company had increased from 2,300 to 2,800. The quarterly report of the committee shows that at the close of the quarter ending Sept. 30 the surplus was $3,841,714.78. The net revenues for the quarter ending Dec. 31 are estimated at about $1,750,000. This amount, added to the surplus for the quarter ending Sept. 30, gives $5,591,714.78. After appropriating for interest on bonded debt, sinking funds, and a dividend of 1¾ per cent. on the capital stock, a surplus is left of $4,065,509.21. In view of this statement the committee recommend that a quarterly dividend of 1¾ per cent. be declared, and that for that purpose the stock books of the company in New York and London be closed at 3 o'clock on the afternoon of Dec. 20, and be reopened on the morning of the 16th of January next.

SOLICITING BUSINESS FOR THE W. U. CO.—A correspondent narrates the following incident to a Pittsburg paper: "On a recent occasion he happened to be a passenger on a Panhandle railroad train, and after being seated he was much surprised to see that the Western Union Telegraph Company had, so far as appearances went, arranged to supply the wants of the traveling public in sending a person to solicit messages. This time the solicitor secured pay for two messages from two young ladies, collected 65 cents from one and 25 cents from the other. The man who was collecting was known to the trainmen as 'Sheeny,' a person who had run on the train as Union News agent. When questioned by the conductor as to what he was doing, he said the ladies wanted him to send a message for them. The correspondent saw through the scheme and made it known to the trainmen; the young man was brought before the ladies, who identified him; and he was made to forfeit the money he had obtained and notified to vacate." In conclusion, the correspondent thinks this sort of thing should be stopped.

NOT SATISFIED WITH W. U. MARKET REPORTS.—The Board of Officers of the Cincinnati Chamber of Commerce considered a motion on the 7th inst. to cancel the contract with the Western Union Telegraph Company for furnishing the market reports and giving it to the Baltimore & Ohio Company. The complaint against the Western Union is that it exacts more for the quotations than they are worth and charges full rates for all extra words. The local manager of the Western Union says these complaints have been drummed up by members of the Chamber who are friendly to the Baltimore & Ohio. He says the Cincinnati Chamber is the only one in the country, with one exception, that charges the Western Union rent for office room on the floor, and lately the Chamber has refused to admit the collectors of the Western Union to the floor unless they were provided with membership certificates. He does not believe the Baltimore & Ohio can furnish the reports, and says that company is not regarded by the Western Union as an opposition enterprise. The Chamber of Commerce Board postponed final action upon the proposition to get the market reports from the Baltimore & Ohio Company, until their next meeting.

THE TELEPHONE.

VIRGINIA, ILL.—A telephone exchange, with thirty-two instruments, was started on the 30th ult. at Virginia, Ill., and is now in successful operation.

THE TELEPHONE INTERFERENCE CASES.—A dispatch from Washington, of the 11th inst., says: Hon. Roscoe Conkling and other counsel in the telephonic interference case, pending in the patent office, made argument before the board of examiner-in-chief to-day. The argument will occupy several days.

SALE OF THR PIONEER TELEPHONE CO.—The Pioneer Telephone Company has sold its franchises and property to the New England Telephone Company at the rate of one share of Pioneer stock for four shares of New England. The Pioneer Company has had control of the Boston and Lowell extra-territorial business, and its contract for this had two more years to run. It has been paying over 30 per cent. dividends.

THE ROCKY MOUNTAIN CO.—The Rocky Mountain Bell Telephone Company has declared an extra dividend, notice of which has been issued from Salt Lake City, making $1 a share for December. The company under conservative management has accumulated a handsome surplus after paying its regular dividend. Hereafter it will pay dividends quarterly instead of monthly. The directors have decided to increase the rate next year.

THE GROCERS OF LAFAYETTE.—It was lately reported that the Grocers' Association of Logansport, Ind., had struck for a reduction of telephone rentals, and had ordered the instruments to be taken out unless the reduction was made. We learn from Mr. John W. Barnes, the telephone manager of Logansport, that this emeute of the grocers occurred at the neighboring town of Lafayette, and that the indications are that the grocers will withdraw their demands.

WAY DOWN IN ALABAMA.—The telephone exchange of the Southern Bell Co. at Gadsden, Ala., began actual work on July 10, with 26 subscribers. It now has 50, and will soon have a great many more. Gadsden being a thriving manufacturing centre with blast furnaces, foundries, saw-mills, and other industries coming to the front. Mr. W. L. Woodruff, the acting manager, recently engaged in conversation by telephone with Supt. W. J. Cole of the Birmingham, Ala., Exchange, sixty-seven miles off. The voices were heard most distinctly.

THE OVERLAND CO. IN PHILADELPHIA.—M. H. Alberger general manager of the Baxter Overland Telephone and Telegraph Company, appeared before a sub-committee of Councils at Philadelphia on the 28th ult., to explain the status of the company. They had effected a reliable organization and communication by means of the general exchange from any local point with any part of the State. He claimed that their instrument would insure perfect hearing at a distance of 800 miles. Banks and merchants in the same business will have private wires.

A NEW FORM OF RECEIVER.—A young man of steady habits, says the Fall River (Mass.) *News*, of the 28th, who has been working at his trade of wood-turning at Newport, arrived at his home in this city last night. After retiring he dreamed that the telephone bell rang, and he stepped to the instrument to reply. He put the cup to his ear and called (Ben Butler style), "Hello, central! What's the matter? Be you all asleep?" Just then the clock in the room commenced striking, which caused the young man to wake up. He was sitting up in his bed with one of his boots in his hand, holding the open end of it to his ear.

UPROOTING THE POLE BY NIGHT.—The telephone company of Altoona, Pa., recently replaced their former poles by larger ones, and placed them in new localities. The proprietor of the Opera House refused to allow the company to place a pole in front of the Opera House. Late one night last week a gang of men placed the pole in position during the absence of the proprietor. Next morning the pole was found lying in the street, and the curb arranged as though no pole had ever been there. Warrants have been issued by the managers of the telephone company for the proprietor and three other individuals. The indications point to a protracted legal war.

PITTSBURG PATRONAGE OF THE 'PHONE—In conversation with a local newspaper man, one of the chiefs of the Pittsburgh, Pa., Exchange stated recently that there are about 1,400 telephones in use in that city, on 982 wires, at a charge ranging upward from $7 per month, according to the length of the line. The longest circuit is that extending from Pittsburgh to East Liverpool, a distance of 46 miles; and connection has now been made with Wheeling, W. Va., as mentioned last week. The Exchange also communicates with Steubenville, O., Beaver Falls, Rochester, McKeesport and Mansfield, Pa. The Superintendent is Mr. H. Metzgar. The day force is composed of 32 persons, and the night force of 7. Very little work, in proportion, is done after dark in Pittsburgh.

OPERATIONS AT WASHINGTON, N. J.—Messrs. J. V. Stout and Edwin Wilson, of the Pennsylvania Telephone Co., have arranged to run a telephone line from Hackettstown, N. J., to Easton, Pa., a distance of about 22 miles, taking in Washington Broadway, N. J., Stewart's Hill, Phillipsburg, and several other small places. They have already 15 subscribers at Hackettstown and 15 at Washington. Mayor Beatty, at the latter place, takes 4. Mr. Charles H. Davis, Supt. of the Beatty Organ Works, is an old-time telegrapher, and he does not fail to take an active part in these matters, and largely through his agency the works have not only telephone and telegraph lines connecting depot, factory, main offices and private residences, but are fitted with electric clocks and bells, and are illuminated by the electric light.

THE MISFORTUNES OF AERIAL WIRES.—A recent occurence at Denver, Col., shows that it is not always cheapest to run wires above ground. On the 5th inst. a snow and wind storm visited that part of the country, and in disastrous effects is without parallel in the history of Colorado. Snow commenced falling at noon and continued all night. The weather was warm, and the snow attached itself to telephone wires until they were two inches in diameter. At 4 next morning the wind blew almost a gale. In about half an hour 300 poles, 18 inches in diameter, were blown down, carrying a mass of wires. A dozen squares were blockaded. All teams were delayed until the evening. Outside communication was completely cut off. The telephone companies will probably lose $15,000. The damage to railroads, telegraph, electric light and the District Messenger Company is heavy.

ANOTHER INSULATOR.—The Detroit *Evening News* says that J. W. Tringham, manager of the Windsor Telephone Exchange, has devised an improvement in the construction of telephone lines. The improvement consists of insulators, which do away with the glass cups entirely. They are made of common hard wood and are of the same size as the side blocks and cross-arm pins now in use. A groove about one-eighth of an inch wide and two or three inches deep is made in the lower end of the blocks, or pins. Into this groove the wire is placed and is insulated by having a piece of thin rubber, two inches square, laid over it. The wire is held in place by a screw which closes the ends of the grooves, and it is held in place as securely as if fastened in a vise, the rubber keeping it from coming in contact with the wood. This constitutes the whole improvement, and while costing only one eighth as much as the insulators now used, the clearness and distinctness that result in the use of the telephone are said to be wonderful.

THE TELEPHONE IN MEXICO.—Last week we published some particulars respecting the sale of telephone rights in Mexico to the Central Co. This corporation had on Oct. 1, it is claimed, over 260 subscribers in connection with its four exchanges, and has applications for many more. In its territory there are five cities of over 50,000 inhabitants, three of over 20,000, and seven of from 5,000 to 10,000, and in all 18 to 20 of sufficient size to warrant telephone exchanges. The Mexican Central, the Mexican National and the Mexican Oriental, Interoceanic and International railroads pass through and connect their chief cities, and whatever growth awaits Mexico will naturally take place along the route of these lines—especially

on the Mexican Central. During August and September, 1883, 69 subscribers were added to the four exchanges in Guanajuato, San Louis Potosi, Zacatecas and Leon. In August the calls for connection were 12,488, and in September reached 19,916. About $30,000 has thus far been expended in plant by this company.

A CHAPTER OF ACCIDENTS.—The Central Union Telephone Exchange, of Dayton, O., has again been tried by fire, the third time within the last two years. Last March a large dry goods store occupying the same building, but separated from the Exchange by a fire-wall, was burned down, and the Exchange was slightly damaged by fire and greatly injured by water, no fewer than 150 lines suffering. Last May, during a heavy thunder-storm, the tower of the Exchange caught fire by the sparking of the lightning from the arrester to the ground strip, igniting the insulation of the cables. The roof of the tower was burned through, and the destruction of about one-half of each of the eleven cables necessitated nearly 550 splices. The third fire occurred on the night of the 7th inst., when the tower was partially destroyed. Owing to defects, it is said, in the line construction of the Electric Light Co., about a dozen telephones have been burned out and as many annunciators destroyed; and on the night named, the Electric Light lines—which do not, as a rule, clear the telephone lines by many inches—became so weighted with rain that they crossed the telephone wires, burned out three instruments and three annunciators, and the tower. It is to be hoped that the Exchange has now experienced the last of these trials by fire.

SCRANTON (PA.) FIRE ALARM SERVICE.—The city of Scranton has a contract with the Telephone Company for 14 fire alarm stations at $700 a year. The Telephone Company have built lines exclusively for this purpose, and in addition to the telephones required by contract have added other machinery to secure greater efficiency. The wires centre in the Exchange, and are so arranged that any call sent in immediately starts an alarm bell. An operator sits by this alarm day and night, and by simply touching a key blows the district in which the fire is reported on the Oxford gong, and gives exact location of the fire to the different engine companies. The records carefully kept of all fires for the past two years show that out of eighty-four fire alarms sent in, forty-nine of these were from subscribers' telephones. This record clearly proves that every telephone is a fire alarm station, and that there are therefore 400 alarm stations scattered throughout every portion of the city. The construction of the present system did not cost the city a single dollar, and the entire cost of maintaining and operating it is only $700 a year. Since its inception the city has had no serious fires, because a telephone was always near at hand to call out the fire department and enable them to reach the fire before it gained headway. The present system is said to be all that can be desired for economy and efficiency.

THE ELECTRIC LIGHT.

J. MURRAY FAIRCHILD, for the past twenty-seven years a well-known Connecticut electrician, has been employed by the U. S. Electric Light Co., as an expert.

NORFOLK, VA.—The Norfolk (Va.) Electric Light and Power Company has been incorporated. Its capital stock is not to exceed $100,000 or to be less than $15,000. Mr. E. V. White is president.

TO LIGHT HIS EVENING DRIVE.—Mr. A. de Rothschild, who is now residing at Halton, his seat in Buckinghamshire, England, has had his carriage lighted by electricity, in order that he may be able to read during his evening drive.

CONNECTICUT AROUSED.—Four cities in the Nutmeg State, ranging in population from 10,000 to 30,000, are considering the practicability and advisability of the introduction of the central-station electric lighting system, using the Edison light.

NEW HAVEN, CONN.—On the 1st inst. the city of New Haven, Conn., was illuminated by the New Haven Electric Company with the Thomson-Houston electric light. The dynamos are driven by Armington & Sims engines. Four circuits, each containing twenty-five lights, are used.

THE LOFTIEST IN THE WORLD.—The electric light at the Silver Cord Mines, Leadville, Col., is probably situated at a greater elevation above sea level than any other in the world. Its height is 11,000 feet. The plant used was furnished by the Excelsior Co., of New York. Nine arc lights are employed on surface workings, and incandescent lights for offices and residences.

THE LIGHT FOR LORDS.—The electric light bids fair to be the light of the immediate future in English country houses. Lord Salisbury, who is of an experimental and scientific turn of mind, was the first to use it in a country house. That was four or five years ago. Then the Duke of Sutherland followed the example of Trentham, and now Lord Thurlow is lighting Dunphail Hall by electricity. Not only are the house, the offices and the house farm to be thus lighted, but several of the mills on Lord Thurlow's Morayshire estate are to be worked by electricity.

NOTES FROM PORTLAND, ME.—Mr. Fred. Johnson has been appointed electrician of the Weston Electric Light Co., at Portland, Me., in place of Mr. Jared Crane, who resigned to accept a similar position with the American Light Co, there. The Weston Co. are running 40 arc lights and 150 incandescent lights, and have orders on hand for 800. Mr. M. P. Devine is acting assistant electrician with the company. The American company are running 120 arc lights; and Mr. Arthur Cooper, formerly with the Telephone company, is working for them.

SIGNALING BY ELECTRIC BALLOONS.—Modern strategy in war requires new means of communication. A method of signaling by means of electric balloons was recently tried in Paris by MM. Mangin and Baudet. The balloon, made of paper rendered translucent, was about eight feet in diameter, and was filled with pure hydrogen. A Swan lamp was fitted inside, and a light rope carrying two copper wires was attached. When the circuit was completed, the whole balloon appeared to be a globe of fire. By switching the current off and on the Morse code can be spelled out, and thus captive balloons of this kind can be used for signaling purposes.

IN THE "QUEEN CITY" OF THE NORTHWEST.—Elgin, Ill., has been successfully lighted by the Van Depoele Co., through the agency of the Elgin Electric Light Co., of which Mr. George S. Bowen is President. There are 29 lights upon seven towers made by the firm of O'Beirne Bros. & Co. The Elgin *Daily News* speaks of the illumination of the city by the light as highly successful, and devotes a whole page to a report of the inaugural banquet given by Mr. Bowen at the Nolting House. The price agreed upon for the supply of light is $8,600 per annum. Mr. Bowen has, it appears, agreed to provide, operate and maintain for five years the electric plant, and to run the same to the satisfaction of the city council. The agreement provides that the city can at any time purchase the towers.

A NEW ELECTRIC LAMP.—The Grand Rapids (Mich.) *Eagle* devotes almost a column to Mr. W. M. Thomas, electrician of the Grand Rapids Electric Light and Power Co., as one of the foremost electricians of the age. He has invented, says the paper, a new arc light, soft and mellow, but more brilliant than the Brush or United States light, and giving from 15 to 35 per cent. more light than they. For him is claimed the honor of having solved the problem of running incandescent lights on a direct circuit in an arc light system, and he is said to have invented a dynamo or generator radically different from all others in use, and far superior to them. "From the merits of his apparatus," says the *Eagle*, "and the well known push of the capitalists interested in the company, it is safe to predict that in the near future that branch of business will become one of the most important in our city, and Grand Rapids will be the home of a man who will rival Brush, Edison, Maxim and other inventors in electric lighting."

ON THE STAGE AND IN THE BALLET.—The electric light is now employed as a means of heightening melodramatic effects on the stage, and hardly a ballet is now considered perfect without it. The latest use of it is in a new operetta, called "Die Assassinen," written by the Austrian Archduke Johann, and produced at Vienna during November. The second act keeps the audience literally spell-bound. The stage represents a forest in the dead of night. A marvellous effect is produced by the use of small electrical lamps, worn on the heads of the ballet dancers, while by an entirely novel appliance swarms of fireflies are made to quiver and dart about the stage in truly realistic fashion. This beautiful illusion, which was investigated by a correspondent of the London *Daily News*, is produced by means of long, flexible wires hanging from the flies, to which wires the incandescent lamps are attached. These latter are alternately lighted and extinguished by a system of switches, worked like the keys of a piano-forte. The lights appear and disappear, flash and dance in mid air, like veritable fireflies.

MISCELLANEOUS NOTES.

MR. E. WARD WILKINS, traveling representative of Messrs. Partrick & Carter, was in New York on Thursday last.

SWIFT'S BOOK.—Mr. James Clugston, of Catasauqua, Pa., says: "Swift's 'Practical Telegrapher' received today. It is comprehensive, and yet it is clear enough for all to understand. Will do my best to introduce it in this region." Mr. C. M. McCahan, of Huntington, Pa., writes: "It is just what I wanted."

ARE TORNADOES ELECTRICAL?—The question whether tornadoes are electrical in their origin has been before the courts in Wisconsin. A Mineral Point man had insured his house against fire, and when it was destroyed by a tornado he sued for the amount of the policy, on the ground that the primary cause of its demolition was lightning, and not wind. The decision is that tornadoes are wind only.

A $500 PRIZE OFFERED.—Among other prizes announced by the English Society of Arts is the Howard prize of £100, which is offered for the best essay on "The Utilization of Electricity for Motive Power." Preference will be given to that essay which, besides setting forth the theory of the subject, contains records with detailed results of actual working or experiment. The society reserves the right of publishing the prize essay.

THE FRENCH PRIZE OF 50,000 FRANCS.—The prize of 50,000 francs that has been offered by the French Government for the discovery that shall enable electricity to be applied economically as a source of light, of chemical action, of mechanical power, as a means of the transmission of intelligence and as a remedy in the treatment of disease, is declared open to competitors of any nationality, and will not be awarded until December, 1887.

JOHN B. SABINE, LL.B., attorney and counsellor at law, 102 Broadway, is counsel for various electrical corporations. He gives special attention to corporation law in all its branches, investigates the condition of companies, advises capitalists and syndicates, obtains patents and concessions, and acts as registrar and transfer agent for certain unlisted companies. His services are offered to those who appreciate care and thoroughness combined with reasonable charges.

UNDERGROUND CABLE CONSTRUCTION.—The Standard Underground Cable Company have purchased property at the corner of Sixteenth and Railroad streets, Pittsburgh, and will proceed at once to the erection of a building 100x170 feet, in which will be manufactured the underground cable invented by R. S. Waring, the electrician. The success of the invention is already assured. Several miles of the cable are already in successful operation in connecting the Government departments at Washington, as stated in THE ELECTRICAL WORLD, and a line is now being laid for the use of the fire department of that city.

SEPARATING METALS FROM THEIR ALLOYS.—An ingenious process of separating metals from their alloys by electrolysis is reported in the London *Times*. The experimental trials were illustrated by the treatment of base bullion, which ordinarily consists of gold, silver and copper. In the described process, the alloy is suspended in a bath of dilute sulphuric acid contained in porous conductive cells placed in tanks containing a solution of sulphate of copper, in which plates of copper are suspended. The alloy and the porous cells are connected by means of copper rods with the positive pole of a Gramme dynamo machine, the copper plates being similarly connected with the negative pole of the machine. The current of electricity passes through the alloy to the acid solution, which is thus decomposed, and combines with the oxidizable metals, such as silver and copper, producing oxides of those metals which enter into solution. The more negative metal, in this case gold, not being affected, is thrown down and afterward removed from the bath, washed, smelted, and run into ingots and bars in the usual way. The silver and copper are also recovered separately, and are similarly treated. One special feature is that the sulphuric acid in solution is used over and over again, and hence a great economy is claimed, as well as by reason of the metals being separated in a perfectly pure state. The apparatus, moreover, is simple and inexpensive, consisting of nothing more than the dynamos with their driving power and the tanks and connections.

STOCK QUOTATIONS.—Telegraph, telephone and electric light stocks were quoted as follows on Thursday, at the Electric, Manufacturing and Miscellaneous Stock Exchange, and at the Stock Exchange:

	BID.	ASKED.
TELEPHONE.		
American Bell Telephone	185	189
Bay State Telephone	98	99
Boston & Northern	100	105
Central American	115	.. .
Continental	9	25
Dolbear	5	10
Erie	37	50
Hudson River	95	110
New York and New Jersey	85	...
New York and Pennsylvania	75	....
National Bell (new)	65	70
Overland	3	7
Shaw	10	17
Southern New England	180	190
Suburban	100	110
Southern Bell	95	125
Tropical	1¾	2
TELEGRAPH.		
Commercial Telegram, pref	....	125
Postal Telegraph (stock)	4¾	5
Postal Telegraph Bonds with stock	....	48
ex. "	43	45
Postal Telegraph (new Co.)	1½	5
Western Union Telegraph	78⅝	78¾
Bankers and Merchants' Tel	. ..	119½
Am. Tel. & C. Co	62	63
American District Telegraph	16	28
Mutual Union Telegraph	16	17
ELECTRIC LIGHT.		
American	....	5½
Brush	80	95
Brush Illuminating	60	85
Daft	...	110
Edison	140	165
Edison Illuminating	38	55
Edison Isolated	100	....
Edison, European	10	30
Excelsior	....	35
Fuller Electrical	10	30
Swan	40	95
United States	110	114

AERIAL NAVIGATION.—The subject of navigating the air continues to occupy the attention of many investigators and experimenters. There is a feeling prevalent in many quarters that electricity alone can supply the motive power

of a thoroughly successful balloon or aerial navigating machine. M. Gaston Tissandier and his brother Albert, the French electricians, have now constructed a balloon with an electrical propeller, consisting of the balloon proper, the gas generator and the electromotive apparatus driven by a battery of 24 bichromate cells. The balloon is cigar-shaped. 28 metres long and 9.20 metres in diameter. Its volume is 1.060 cubic metres, and an automatic valve is provided. The car is constructed of bamboo, and is suspended by ribbons. The balloon was filled on Oct. 8 in seven hours by four hydrogen generators, liberating pure gas by the decomposition of water in presence of iron and sulphuric acid. The gas was purified by caustic soda and calcined chloride of lime. The pure gas thus obtained gave an ascensional force of 1.180 grammes weight per cubic metre of gas, a higher result than has hitherto been obtained. The electric balloon, with its motor able to act three hours, weighs 704 kilogrammes. To this the weight of two persons has to be added, say, 386 kilogrammes for M. Tissandier and his brother. On Oct. 8, about 3:20 P. M., these gentlemen ascended from their workshops at Auteuil, near Paris, in a feeble east-south-east wind. At the earth the wind was almost *nil*, but at a height of 500 metres the wind obtained a velocity of 3 metres per second. The electric apparatus allowed of four speeds of the propeller, from 60 to 180 turns per minute, and the aeronauts proved that they could outspeed and breast the wind, as well as steer the balloon in it. They descended an hour later near Croissy-sur-Seine, well satisfied with their preliminary essay.

BUSINESS NOTICES.

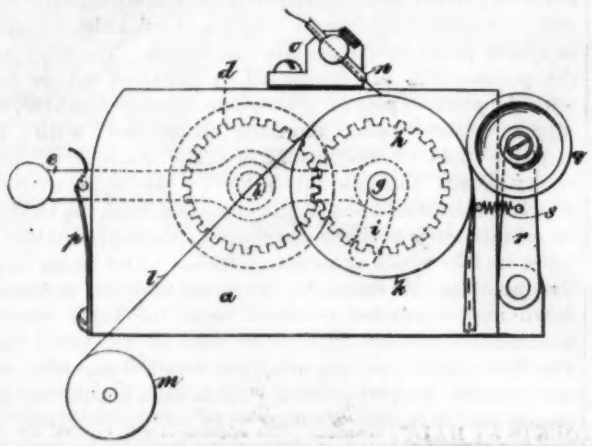
THE U. S. MUTUAL ACCIDENT ASSOCIATION.—This association has literally leaped into popularity, and its membership is increasing daily at an unparalleled rate. On January 1 the membership fee is to be increased to all whose applications have not been received before that date, so that those intending to avail themselves of the substantial benefits offered should not delay. The president of the company is Charles B. Peet, of Rogers, Peet & Co., and Mr. James R. Pitcher is secretary. Application blank will be forwarded to any address, and on its return filled up and accompanied by $4, a policy will be promptly mailed.

THE "ELECTRICAL WORLD'S"
ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

ALL THE PATENTS MENTIONED BELOW ARE DATED NOV. 27, 1883.

Automatic Telegraph; Rufus Anderson, of Peekskill, N.Y. 289,205

This improvement in chemical telegraphs is designed to facilitate the placing of the record-fillet on the contact-wheel under



the stylus, and means are provided for sharpening the stylus in its place in the machine. The arm carrying the contact-wheel is mounted concentric with the driving-shaft, so that it may be raised or lowered for the purpose of introducing the fillet. Another object in making the contact-wheel movable is to introduce a sharpening-wheel under the stylus to grind the latter while in place, motion being imparted to the sharpening-wheel by friction from the contact-wheel. When the sharpening-wheel is not in use, it is pushed back into a recess in the front plate of the machine.

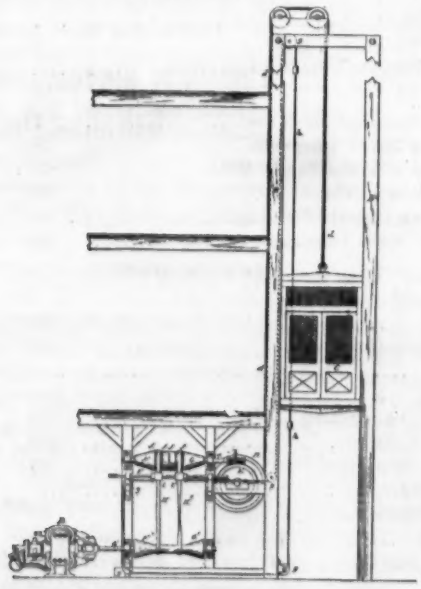
Automatic Shunt-Relay or Circuit-Closer; T. A. B. Putnam, of New York City. 289,137

In this apparatus two electro-magnets act upon one armature-lever in common, and in connection with a commutator act to shunt one magnet out of the circuit and the other into the circuit at each electrical impulse, at the same time breaking or closing another circuit through the movement of the armature-lever.

Automatic Circuit-Breaker for Railroad Signals; M. W. Long, of Hyde Park, Mass. 289,000

This inventor has described in another application for Letters Patent a magneto generator for signaling purposes, which is operated by the passing train. In order to maintain the alarm in operation during the period of time after the train has passed the generator and before it arrives at the crossing, the rotating parts of the generator are made to have sufficient momentum to keep them in motion for sufficient time to allow a slow moving train to reach the crossing. This circuit-breaker is designed to break the circuit when the train reaches the crossing, so that the alarm will not be sounded thereafter whether the trains move slow or fast.

Apparatus for Regulating and Controlling the Electrical Transmission of Power; Edward Weston, of Newark, N. J., assignor to the United States Electric Lighting Company, of New York City. 289,198



This apparatus is represented as applied to an elevator, but the inventor does not limit the invention to this use. The patent covers the system of double cone pulleys and tight and loose pulleys for stopping, starting and controlling the speed of machinery driven by electric motors.

Apparatus for Charging and Discharging Secondary Batteries; Edward Weston, of Newark, N.J., and Leonard E. Curtis, of New York City. 289,328

In charging secondary batteries the weight of the elements varies. Advantage has been taken of this circumstance, and the elements of one cell of storage battery are balanced upon a nicely poised beam, the beam being arranged to control the governing electric circuit and regulate the charging and discharging of the battery.

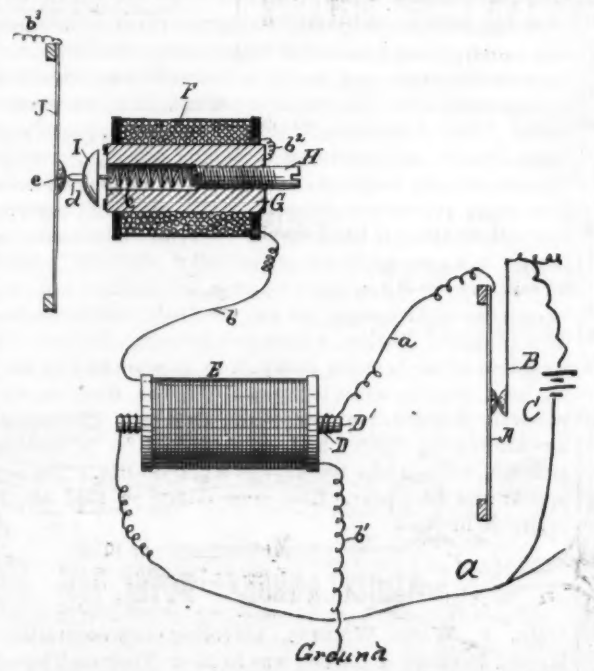
Dynamo and Magneto-Electric Machine; Edward Weston, of Newark, N. J., assignor to the United States Electric Lighting Company, of New York City. 289,200

Brushes of dynamos have always been arranged tangentially to the commutator cylinder. The ends of brushes arranged in this way are beveled by wear, so that the lines of contact are constantly changing. This improvement provides brushes that are pressed against the commutator cylinder on diametrically opposite sides in a plane parallel with two opposite radii of the commutator cylinder.

Electrical Cable; Samuel D. Strohm, of Philadelphia, Pa. 289,164, 289,165, 289,166

These patents cover several methods of constructing cables with wires and insulating discs, rings or supports having open slots for the reception and support of the wires.

Speaking-Telephone; James H. Robertson, of Brooklyn, N. Y. 289,309



A telephone-receiver is placed in the secondary circuit *b b'* of an induction coil, in the primary circuit *D* of which is the transmitter, the secondary circuit being arranged so that the induced current passes through vibration electrodes, as well as the helex *F* of the receiving electro-magnet. By this arrangement the change produced in the primary current by the vibrations of the transmitting-diaphragm are accompanied by simultaneous changes in the secondary current produced by corresponding vibrations of the receiving-diaphragm.

Electric Cable; William Halkyard, of Providence, R. I., Assignor of one-half to Henry A. Church, of same place. 289,092

This cable consists of a number of insulated wires provided with a covering of metallic braid and a coating of soft metal covering the braid and filling its interstices.

Hotel and Burglar Alarm Electric Annunciator; Wm. S. Corwin, of Newark, N. J. 289,233

The drops in the annunciator are fitted loosely on the crank-shaft and a series of fingers carried by the shaft serves to replace the drops.

Relay for Quadruplex Telegraphs; H. C. Nicholson, of Kenton, Ky. 289,301

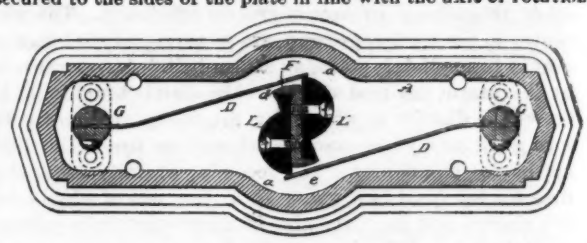
Two armature levers worked by the main line currents are employed in connection with a yielding contact lever to control two local circuits.

Regulator for Electrical Generators; Edward Weston, of Newark, N. J., Assignor to the United States Electric Lighting Company, of New York 289,325, 289,326

These patents cover a main circuit with lamps connected in series therewith, and two or more generators with their armature coils connected in series, an independent circuit, including the field magnet, coils in series and electrically operated apparatus for diverting the current from the circuit around the field magnets, the whole being arranged to maintain a uniform current in the main circuit.

Electric Circuit-Breaker; Edward Weston, of Newark, N. J., Assignor to the United States Electric Lighting Company, of New York City. 289,199

This device is intended for use in connection with circuits on which strong currents are passing, the object being to prevent the formation of an arc. Between the contact springs there is a revolving metal plate, and insulating pieces of irregular form secured to the sides of the plate in line with the axis of rotation.



The circuit can be broken only by the instantaneous reaction of the spring on leaving the exposed edges of the metal plate.

Switch for Electric Lamps; George T. Benson, of New York City, Assignor to John S. Kelso, Jr., of Stamford, Conn. 288,971

This is a novel and ingenious switch for the sockets of incandescent lamps.

System of Generating and Regulating Electric Currents; Edward Weston, of Newark, N. J., Assignor to the United States Electric Lighting Company, of New York City. 289,324

This patent covers a method of running and controlling dynamos in series.

Support for Telephones; James Tregurtha, of Malden, Assignor by mesne assignment to the Adjustable Telephone Support Company, of Boston, Mass. 289,179, 289,180

These patents cover devices for supporting telephone transmitters and receivers in convenient position for use.

Safety Cut-out for Electro-Magnetic Motors; Edward Weston, of Newark, N. J., Assignor to the United States Electric Lighting Company, of New York City. 289,197

A centrifugal governor attached to the motor cuts the motor out of the circuit when its speed is either too high or too low.

Telephone Switch; Chas. T. Loring, of Boston, Mass., Assignor by mesne assignment to the Adjustable Telephone Support Company, of same place. 289,353

In this invention the movement of the switch signals the central office.

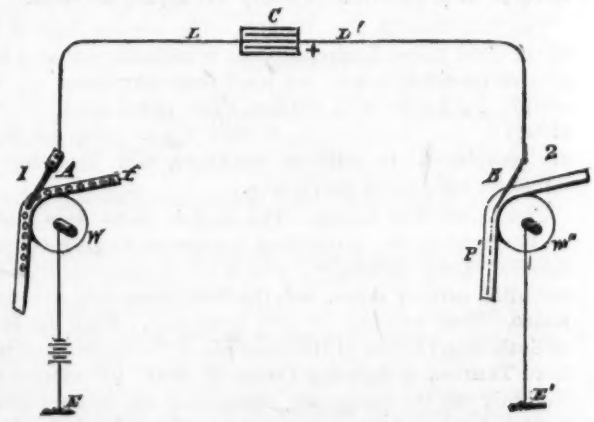
Telephone Switch; James Tregurtha, of Malden, Assignor by mesne assignment to the Adjustable Telephone Support Company, of Boston, Mass. 289,178, 289,321

The switch is operated by the arm that supports the telephone.

Telegraph Relay and Repeater; James A. Maloney, of Washington, D. C., Assignor of one-half to Glen W. Cooper, of same place. 289,285

The legs of the magnet of this relay are formed of bundles of soft iron wire, and only one leg is provided with a coil or helix. The object of the inventor is to produce a relay sensitive to light currents.

Chemical Telegraph; T. F. Taylor, of Brooklyn, N. Y. 289,173



This invention consists in the combination with a telegraph line conductor divided into two approximately equal sections *L L'*, connected for induction through a condenser *C*, of an electric generator *E*, connected with the terminal of one section, a transmitter arranged to make and break circuit, and a chemical receiver and recorder connected with the opposite line terminal and ground. The object of this arrangement is to prevent "tailings."

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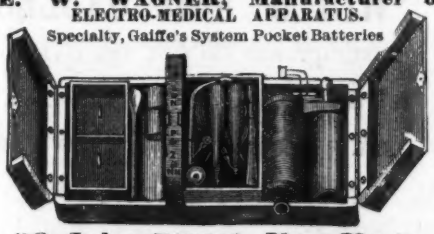

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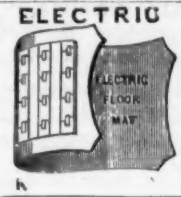

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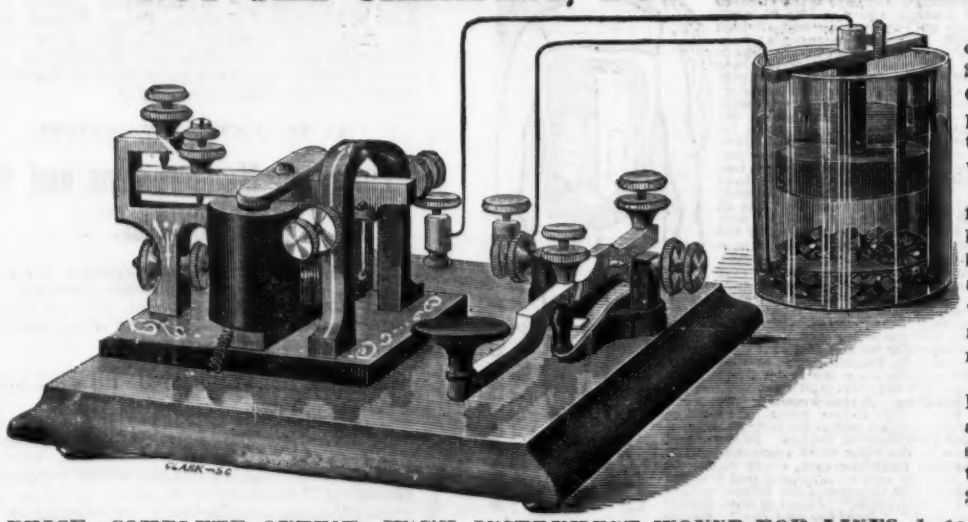

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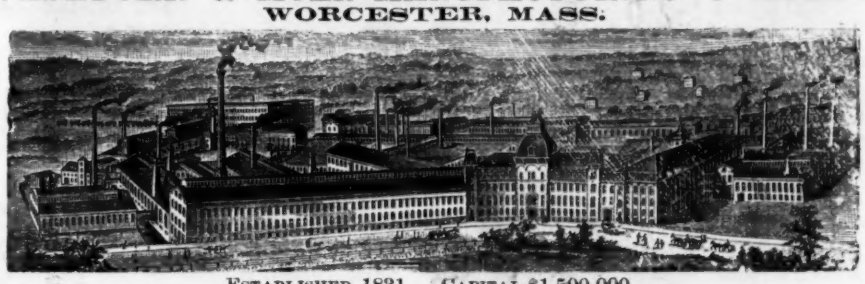

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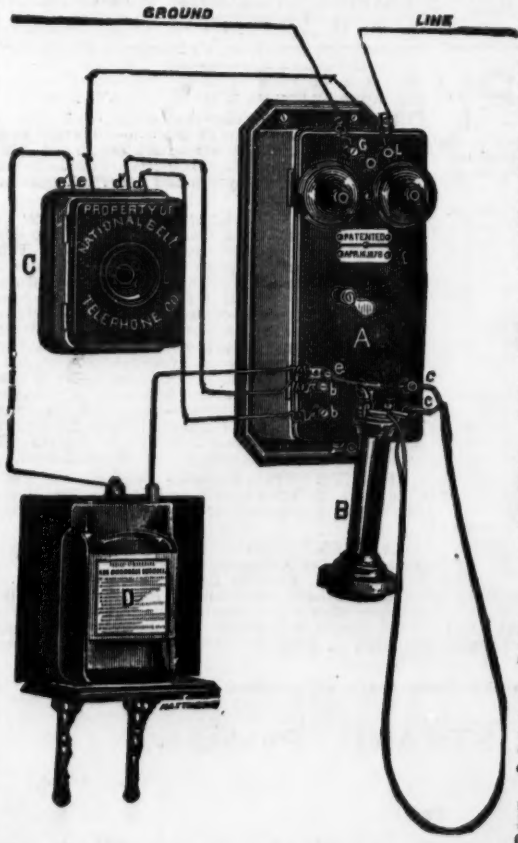

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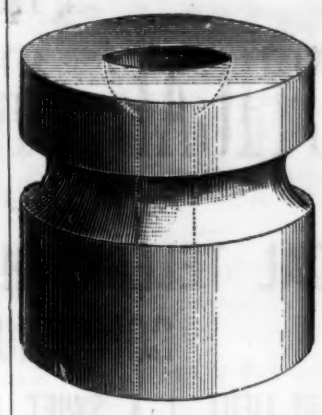

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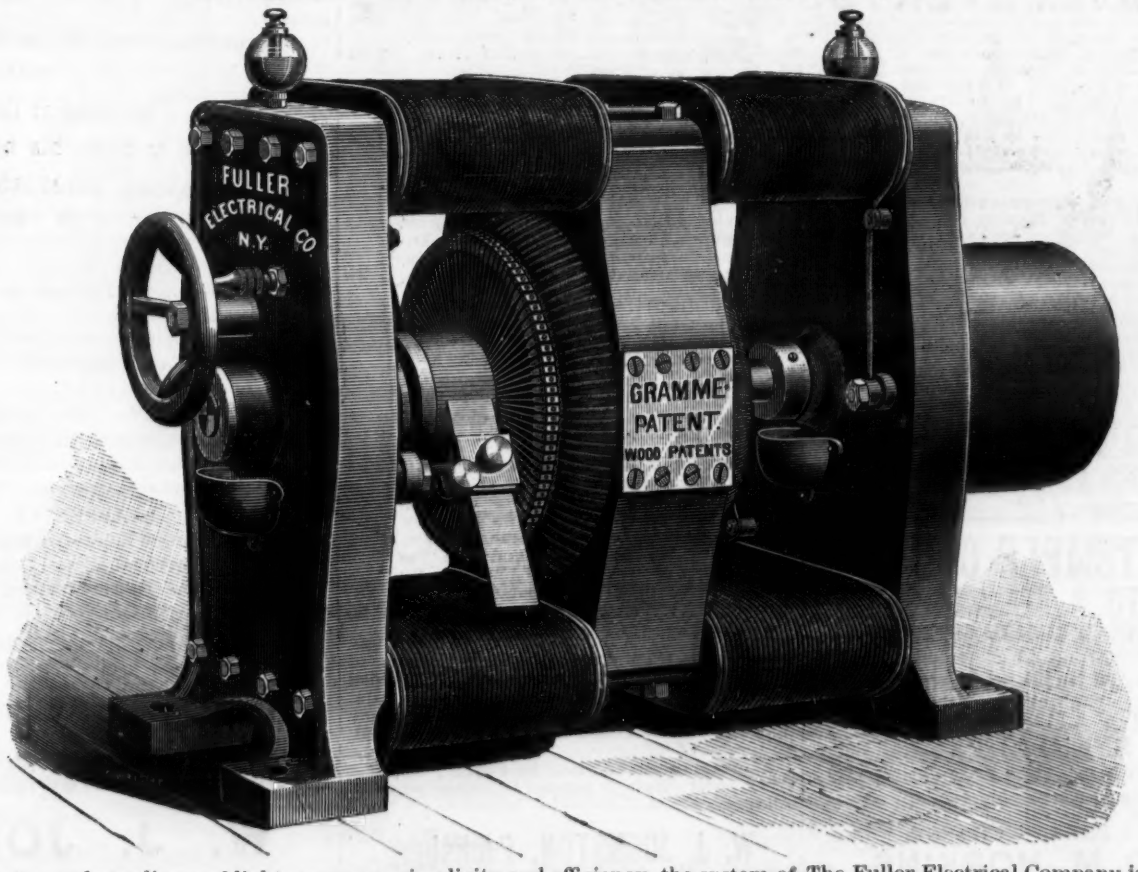

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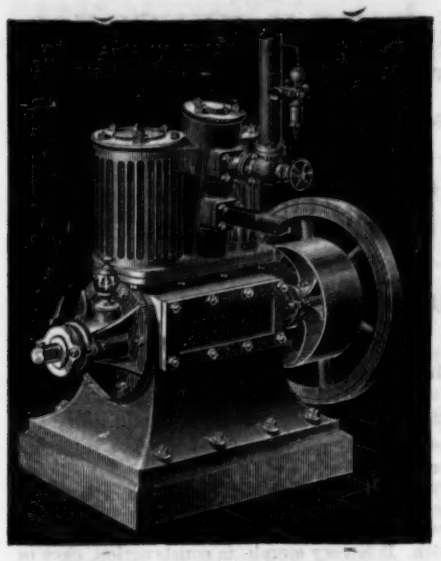

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This company, in connection with its present affairs, will continue the business of the late firm of

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Mr. Davis has transferred to this company (of which he is president)

All Interests of Whatever Nature heretofore pertaining to Davis & Watts, and will henceforth give his personal supervision to the manufacture of electrical goods of every description.

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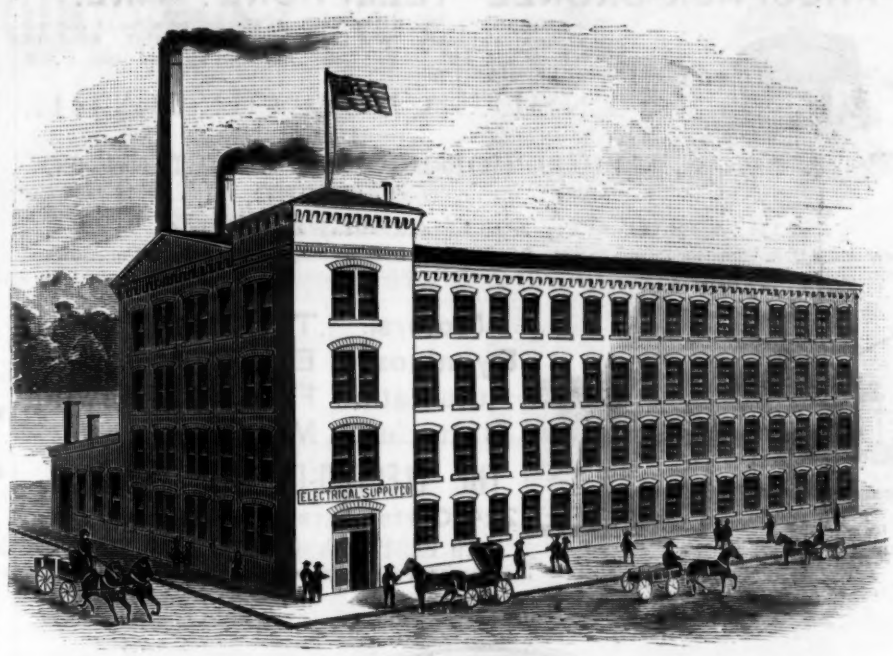

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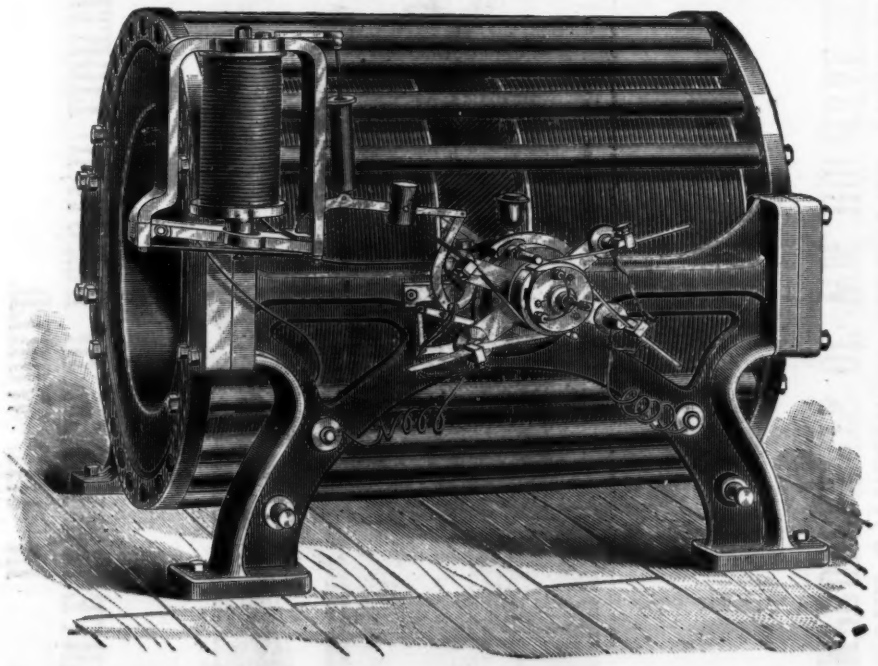

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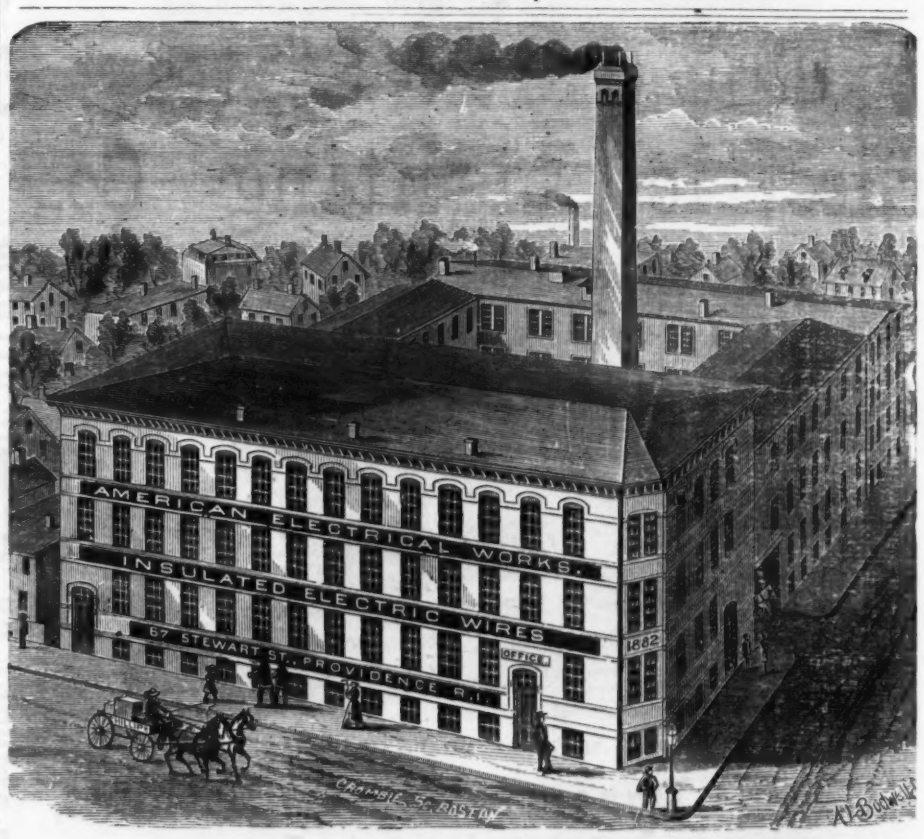

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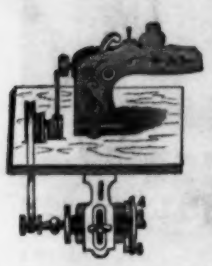

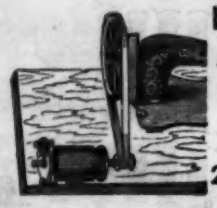

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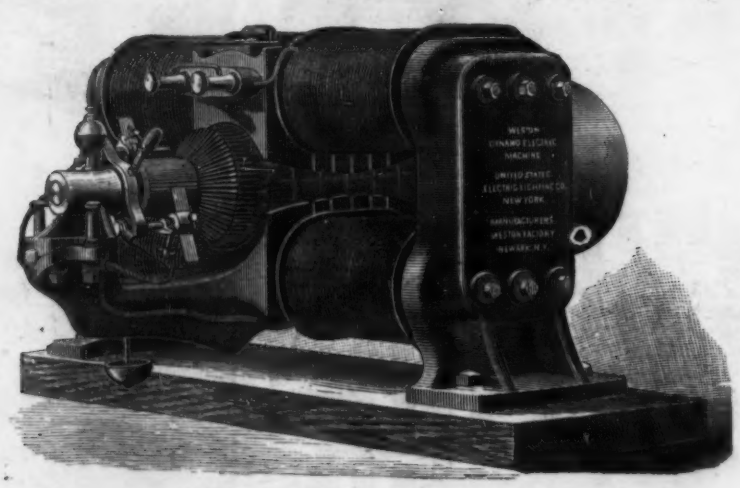

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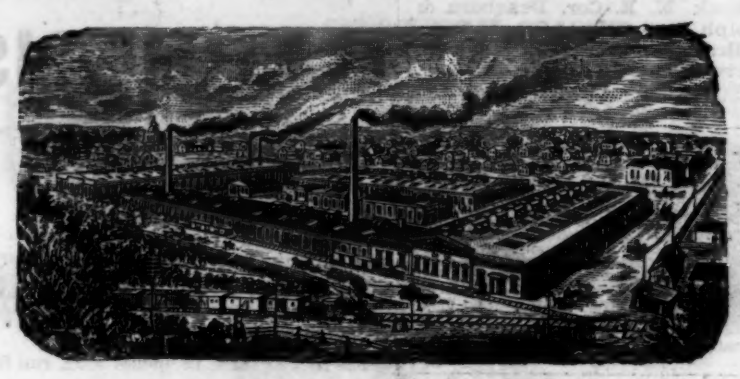

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To fill the large orders which have accumulated on our books. We desire to state that these batteries are

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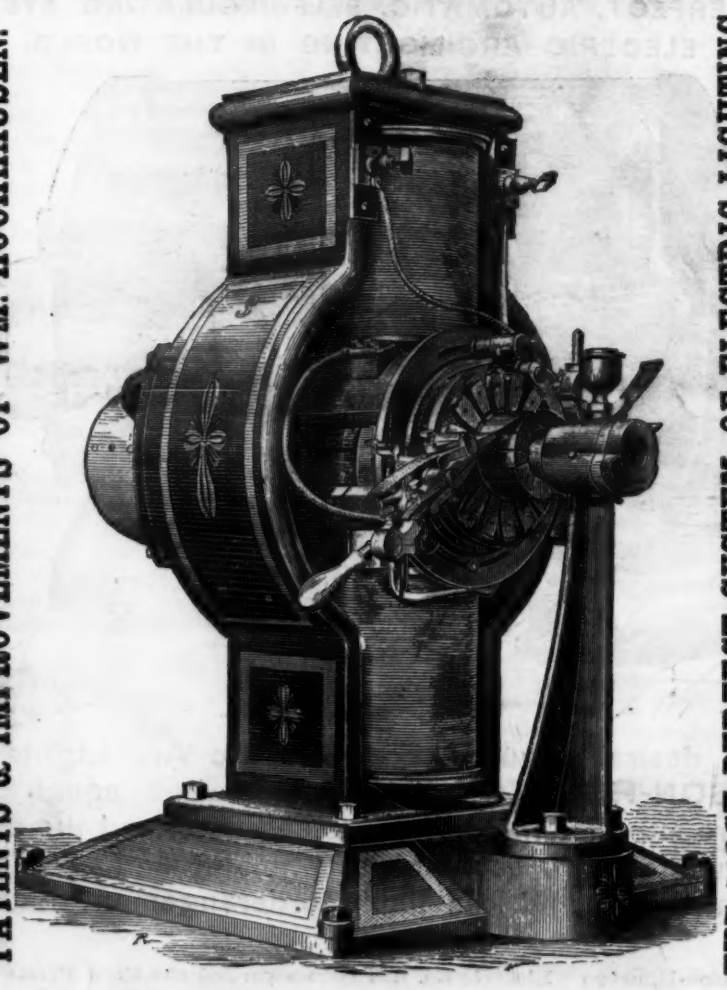

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